The Electrical Industry's Weekly Magazine

September 9, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Photos Relate Tower Height to Flashover Rate

. . . Page 62

What Makes a Good Manager? . . . Page 52

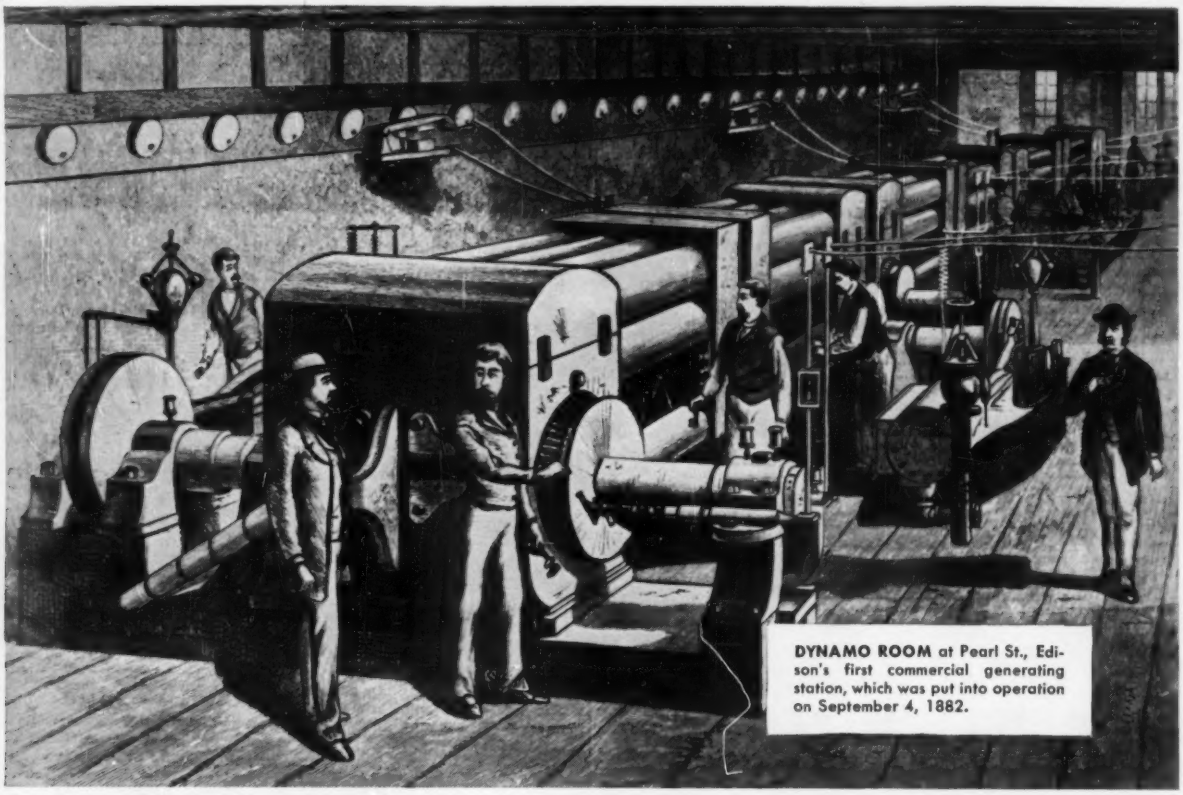
E B POWER GS W 12
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

"SOME SAID MY SYSTEM WAS UTTERLY IMPRACTICABLE"

THOMAS EDISON headed company which was established for the express purpose of developing the incandescent lamp.

From the N. Y. Tribune, September 5, 1882... Many persons in the throng that pours down Fulton-st. had their attention attracted yesterday to the lights in several of the stores. In place of the usual gas-fixtures were those of the Edison Electric Company, each lamp shedding its light from a small blazing horse-shoe that glowed within a pear-shaped globe pendant beneath a porcelain shade. The central station which supplies the electricity for the lamps is at No. 257 Pearl-st.

At this station Mr. Edison and the other employees were found in a high state of glee. Mr. Edison said: "We started our machinery this afternoon and are now prepared to supply my light permanently to the district. Statements have been published recently from some electricians to the effect that my system was utterly impracticable. We have proved today already that it is a success."



DYNAMO ROOM at Pearl St., Edison's first commercial generating station, which was put into operation on September 4, 1882.

75 years ago, Pearl Street Station heralded the evolution of the electrical industry

Today's giant electrical industry is living tribute to the practicability of Edison's first system. The amazing progress made since that September day in 1882 reaffirms a faith that our industry will meet the even more spectacular growth forecast for the future.

Since those early days when the makers and users of equipment were the same individuals, a spirit of pioneering and cooperation has existed among operating utilities and their manufacturing suppliers. This spirit will help us meet the tremendous challenge which now faces us; to install within the next ten years, more capacity than was installed in the 75 years since Pearl Street Station.

Such a spirit of pioneering and cooperation engenders progress. As General Electric looks with pride to its origins in the Pearl Street Station, at some date in the future we will mark our co-operative progress with the utility industry by such milestones as our current contributions to Philo, Eastlake, Huntley and Breed Stations.

General Electric Company, Apparatus Sales Division, Sect. 301-365, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 11 September 9, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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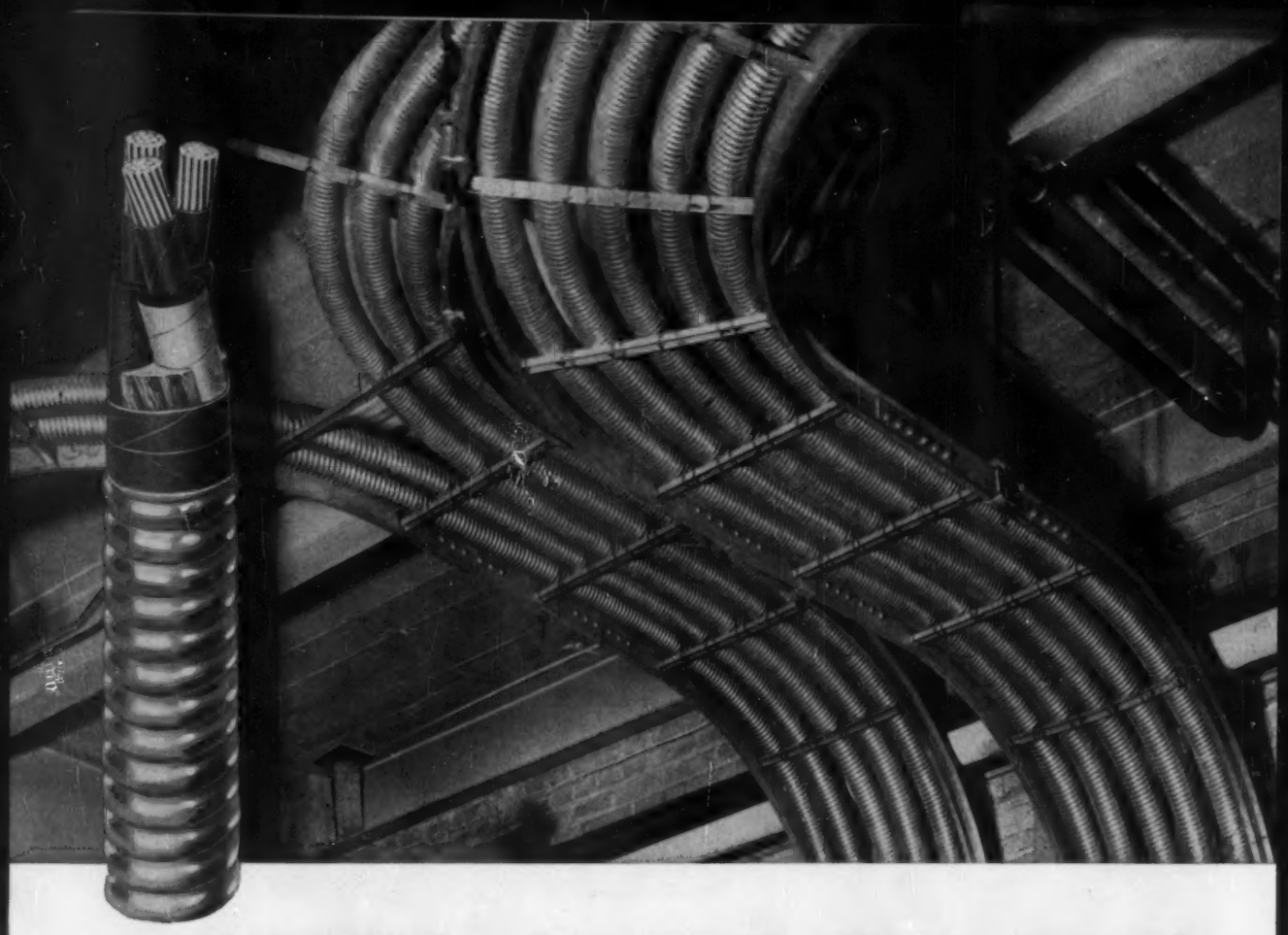

cut cable installation costs the modern way...

with Loxarmor — the modern armored cable whose strength and flexibility make it a cost-saving alternative to conduit-enclosed cable. Rubber-insulated Loxarmor with its interlocking S-shaped armor is ideal for either power or control circuits.

Lower installation costs — Loxarmor eliminates conduit and related installation costs such as making bends and using pull boxes... especially economical to use in cramped quarters.

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Less space required — Multiple Loxarmor circuits require only a little more than half the space needed for equivalent conduit circuits.

Loxarmor can be supplied over any standard Okonite insulation—rubber, varnished cambric or plastic—depending upon your installation conditions and voltage requirements. It is available with galvanized or stainless steel, aluminum or bronze armor. Either copper or aluminum conductors are of course available.

For dimensional data on Okonex rubber insulation applied by the strip-insulating process write for Bulletin EW-1090. Complete splicing and terminating drawings and instructions for Loxarmor are also included. The Okonite Company, Passaic, N. J.

where there's electrical power... there's **OKONITE CABLE**

4740

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. . . from the publisher

Information Please . . .

Dispensing printed information is Electrical World's prime job. Yet the person responsible for dispensing more information than probably any other single EW staffer has never had even a single word published.

She's Josephine Schuster, our No. 1 answer gal, who does nothing all day but fill article reprint orders and answer readers' queries.

The requests she gets come from everywhere, ask for about everything conceivable. From India came a call for everything we've published on right-of-way problems. The director of an Army service club in San Francisco wanted to know about night-lighting for miniature golf courses. He remembered a story we had printed back in 1930. The manager of a small Northeastern utility wanted to know how he should go about getting his company into a power pool.

It sometimes takes a while to get the answer, but Jo's batting average is still better than double anything Ted Williams ever did. A Mexican request for some line fault material once took three months to locate.

Such data digging is part of EW's service. All we ask is: Don't be like the man who wanted to know how to squeeze more juice from a kilowatt. That one had us stumped.

Fischer Black

ELECTRICAL WORLD

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structural details?

. . . many things.

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- A mass flow soot blower is installed as original equipment at the cold end where deposits are most apt to accumulate.
- The hot end heating surface is made from open hearth steel sheet and the cold end from heavier gauge, low-alloy corrosion-resisting material because corrosion is normally confined to the cold end.

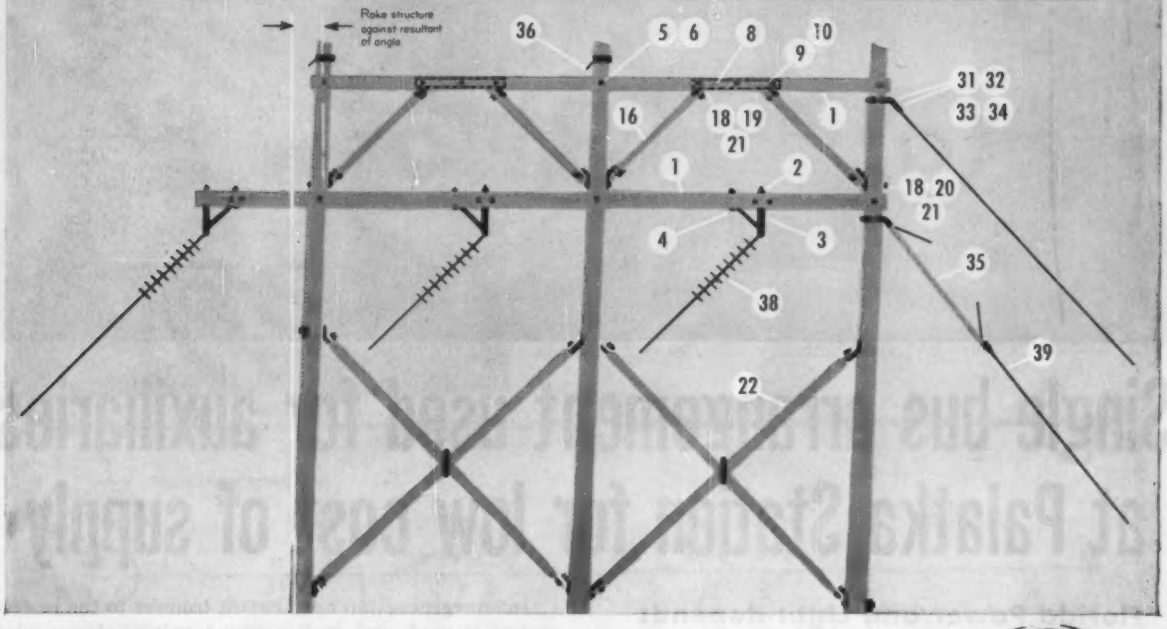
The Air Preheater Corp. is constantly working to improve Ljungstrom heating surfaces, seals, bearings, and other structural details. And, in general, these improvements can be applied to existing units with only minor changes and at nominal cost. Another reason why seven out of ten air preheating installations are Ljungstrom. For the full story on how the Ljungstrom design and construction can cut your fuel costs, increase plant efficiency, write for our 38-page manual.

The Air Preheater Corporation, 60 EAST 42ND STREET, NEW YORK 17, N. Y.

SMALL ANGLE STRUCTURE TYPE NO. 706

NORMALLY USED FOR ANGLES OF 4° – 15°. ADAPTABLE FOR VOLTAGES FROM 69 TO 154 KV

DRG. REF.#	QUANTITY	DESCRIPTION	DRG. REF.#	QUANTITY	DESCRIPTION
706	3	Pole	21	7	MF locknut ⅞"
1	4	Crossarm	22	2 sets	Cross base w/fittings, clamp, ⅞" pole bolts, and curved washers
2	3	Spacer fitting w/mfg. bolts			
3	3	Swinging angle bracket			
4	3	Saddle w/mfg. bolts	31	4	Pole band
5	6	Stud bolt ⅞" w/2 washer nuts	32	4 pr.	Connecting link
6	12	MF locknut ⅞"	33	1	Guy roller
8	2	Filler block	34	1	Machine bolt ¾" x 2½"
9	6	Stud bolt ¾" w/2 washer nuts	35	1	Wood guy strain insulator
10	12	MF locknut ¾"	36	2	Suspension clamp for static wire
16	4	Knee brace			
18	7	Machine bolts ⅞" w/sq. nut	38	As required	Suspension insulators and fittings
19	4	Flat washer 4" sq. x ¼", 1 1/16" hole	39	–	Guying material
20	2	Curved washer 4" sq. x ¼" 1 3/16" hole			



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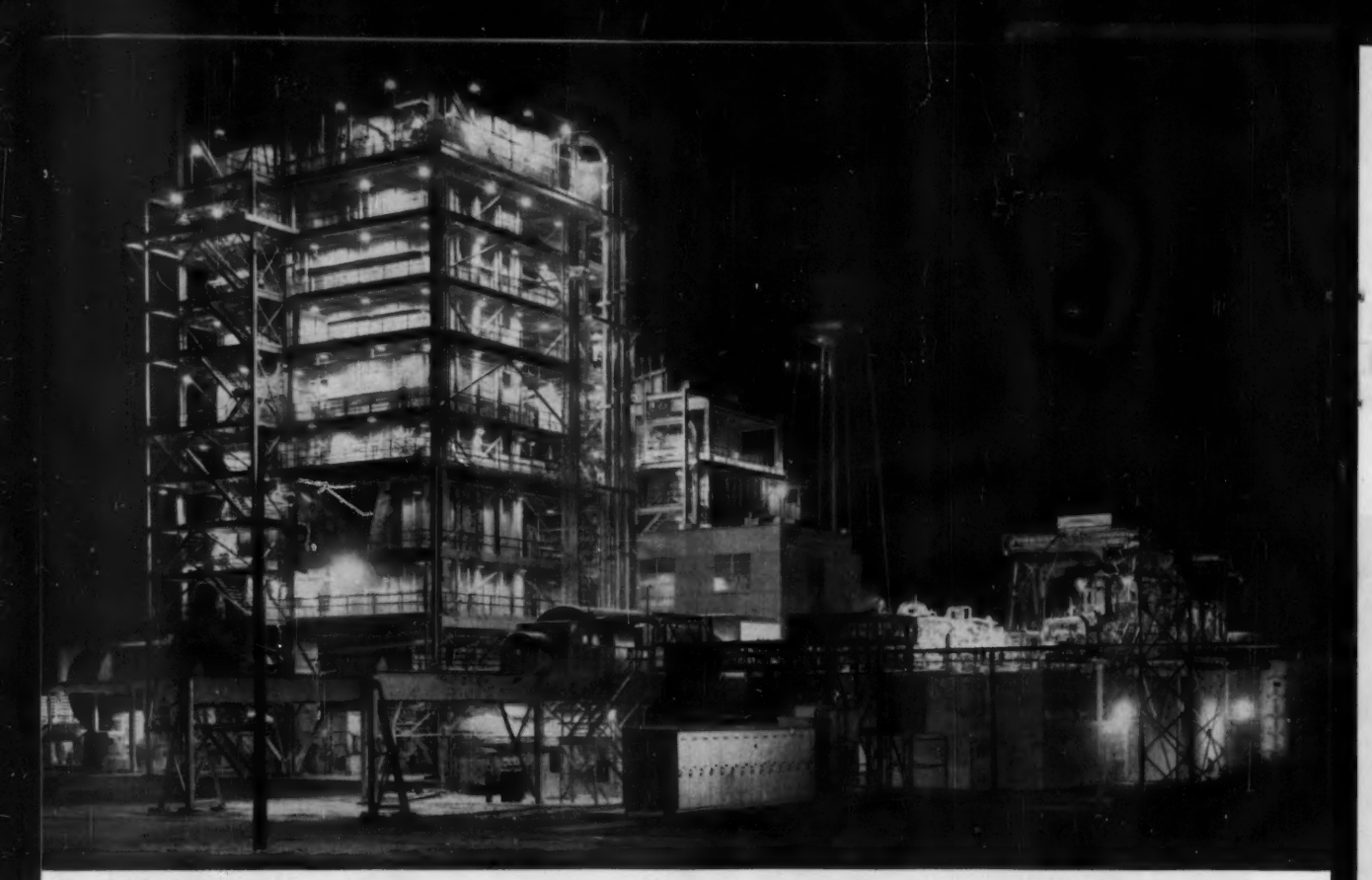


Single-bus arrangement used for auxiliaries at Palatka Station for low cost of supply

Florida Power and Light depends heavily on reliability of Allis-Chalmers switchgear for power continuity of Unit 2

The entire design was based on maximum reliability for a minimum cost of equipment and construction. Outdoor type of construction provided the greatest savings, of course. Keeping the auxiliary supply simple, by using a single bus, also resulted in important savings .

This auxiliary supply scheme places heavy emphasis on the reliability of the Allis-Chalmers switchgear because the entire generating unit is completely dependent on the one bus and one set of switchgear for the essential auxiliary drives.

Start-up power is provided by a tie to Unit 1 auxiliary switchgear bus. A manual synchronized closed-circuit transfer is used during start-up. If generating Unit 2 goes off the line, auxiliaries may be kept in operation by power from Unit 1.

In emergencies, an open-circuit transfer to the reserve source is used, and in this case a voltage decay relay monitors this throwover and permits its completion when residual bus voltage generated by motors has decayed to 25%. Engineers at Florida Power and Light Company found by actual test that a voltage decay of about 75% occurs within 50 cycles.

Structure Mounted Auxiliary Switches

One unusual feature of the switchgear at Palatka is the use of positive acting auxiliary switches on the structure as well as on the breaker. These structure-mounted switches simplify the addition of auxiliary switch contacts and avoid the need of cell switches.

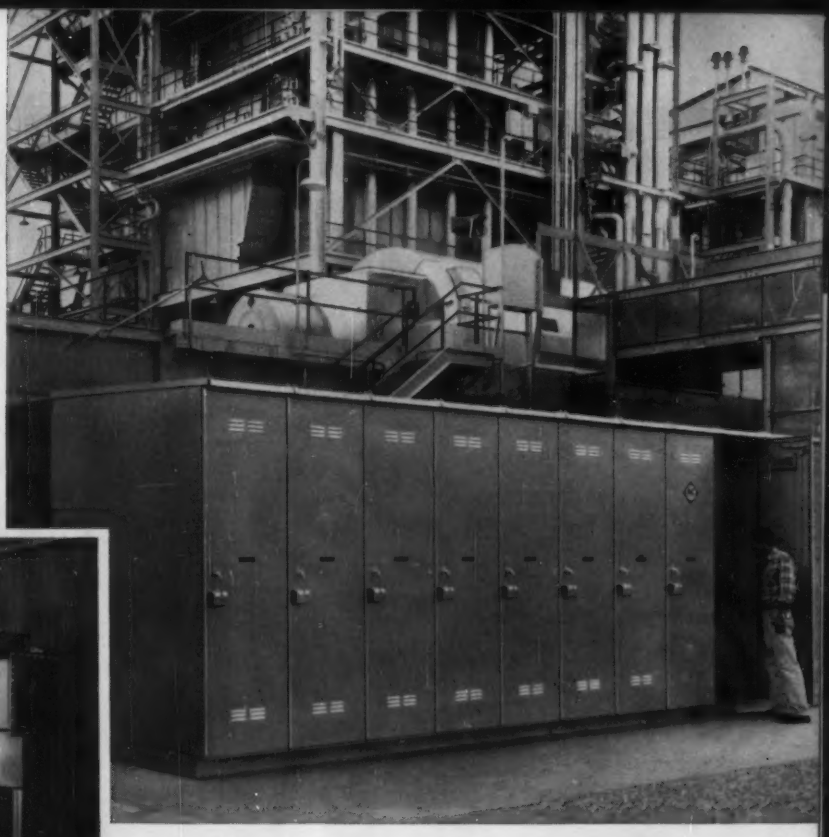
Allis-Chalmers engineers worked in close cooperation with engineers from Ebasco Services, Incorporated and Florida Power and Light Company. This is one of many station auxiliary switchgear lineups built by Allis-Chalmers. For an answer to your switchgear problems, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

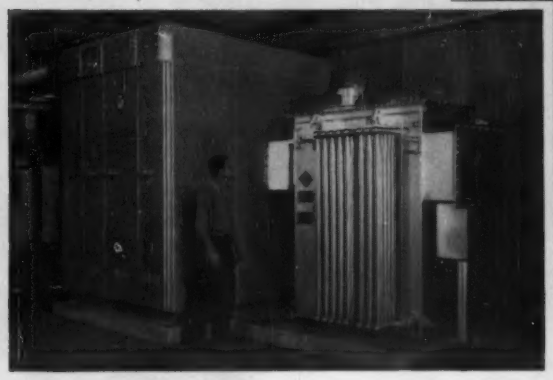
For Progress in Switchgear **ALLIS-**

Palatka Station has an installed capacity of 128,000 kw. Outgoing power is transmitted at 115 kv and 69 kv.

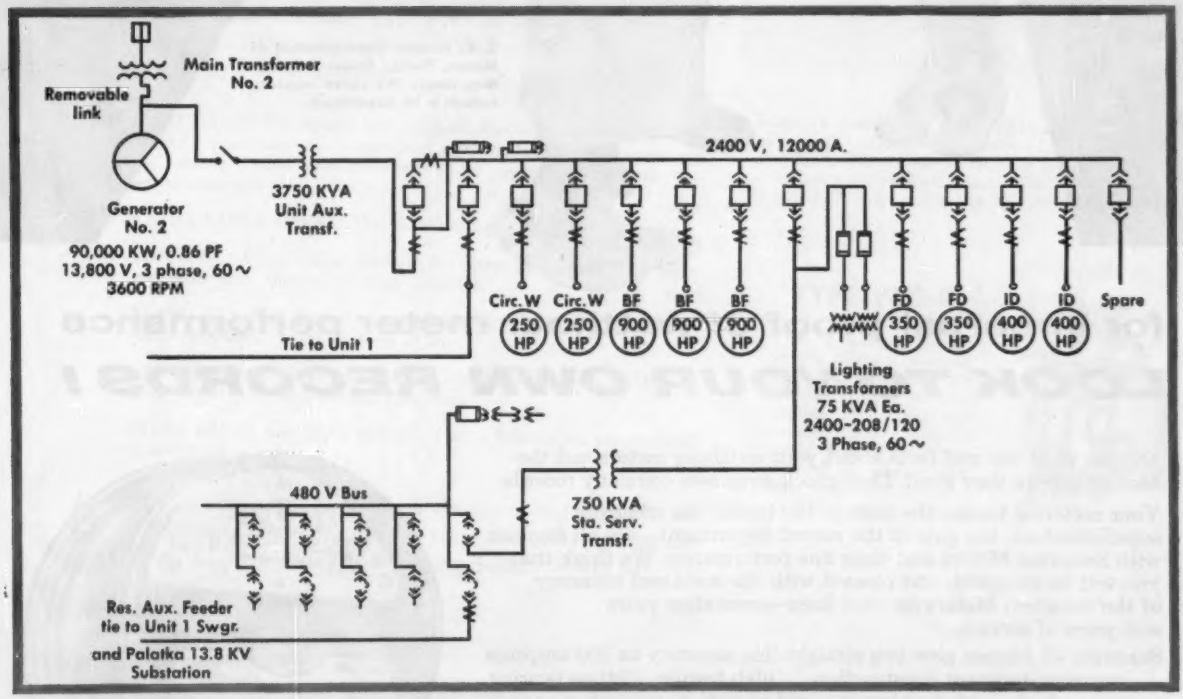
Unit substation type construction was used on both the 2400-volt and 480-volt switchgear to conserve space and provide good appearance.

Allis-Chalmers outdoor-type 480-volt low voltage switchgear is used on circuits for lighting, condensate pumps, lubricating oil pumps, motor control centers and fuel oil boosters.





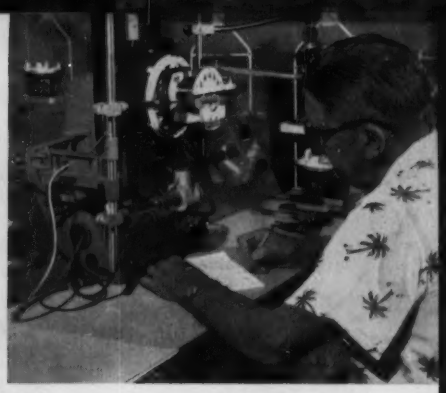
Ebasco Services, Incorporated, Engineers and Constructors.


Main Transformer No. 2
Removable link
Generator No. 2
90,000 KW, 0.86 PF
13,800 V, 3 phase, 60~
3600 RPM
3750 KVA Unit Aux. Transf.
2400 V, 12000 A.
Circ. W 250 HP
Circ. W 250 HP
BF 900 HP
BF 900 HP
BF 900 HP
FD 350 HP
FD 350 HP
ID 400 HP
ID 400 HP
Spare
Tie to Unit 1
Lighting Transformers 75 KVA Ea. 2400-208/120 3 Phase, 60~
480 V Bus
750 KVA Sta. Serv. Transf.
Res. Aux. Feeder tie to Unit 1 Swgr. and Palatka 13.8 KV Substation

CHALMERS

A-C ALLIS-CHALMERS

A-5504



All incoming meters are tested, results tabulated on permanent record cards in the Florida Power Corporation Meter Shop.

S. B. Vaughn, Superintendent of Meters, Florida Power Corporation, checks the meter accuracy records in his department.

for impartial proof of watthour meter performance

LOOK TO YOUR OWN RECORDS!

Do you want the real facts about your watthour meters and the kind of service they give? Then check your own company records.

Your metering team—the men on the bench, the metering superintendent, the girls in the record department—are all familiar with Sangamo Meters and their fine performance. We think that you will be surprised, and pleased with the sustained accuracy of the Sangamo Meters on your lines—even after years and years of service.

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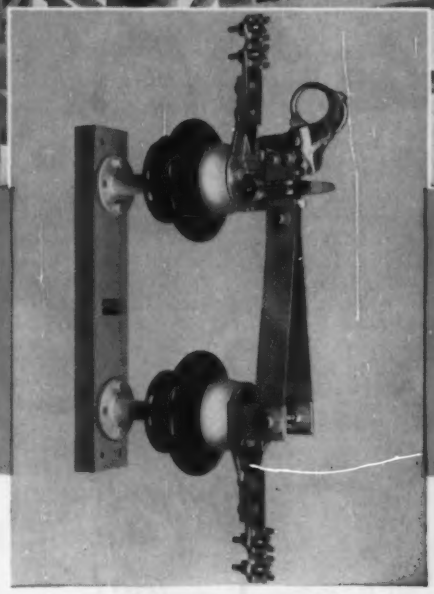
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM57-6

SOUTH CAROLINA — Typical installation of Type PBO Disconnect Switches in South Carolina. They are adaptable for wood-pole mounting on rural lines and distribution feeders.

WHY LEADING UTILITIES SPECIFY SOUTHERN STATES TYPE PBO DISCONNECTS



Thousands of Southern States Type PBO Disconnect Switches are in use from coast to coast, Canada to Mexico. Here is why they are specified by leading utilities:

HIGH PRESSURE double line contacts. Positive contact assured by wiping action of accurately machined surfaces. Hard drawn copper bus bar blades; double blade construction. 90° open position blade stop unless otherwise specified.

EXTRA LARGE OPERATING RING of heavy duty construction.

POSITIVE LATCHING of blade in the closed position prevents opening under fault currents or from vibration.

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STEEL BASES, hot-dipped galvanized after fabrication, are available to specification.

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This regulator by-pass switch offers a compact unit that provides the disconnecting means needed to by-pass and isolate voltage regulators. Available in ratings of 7.5 - 15 kv, 400, 600, and 1200 amps.

SOUTHERN STATES EQUIPMENT CORP.
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NOW... a totally new design

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a product of ROYAL research and engineering

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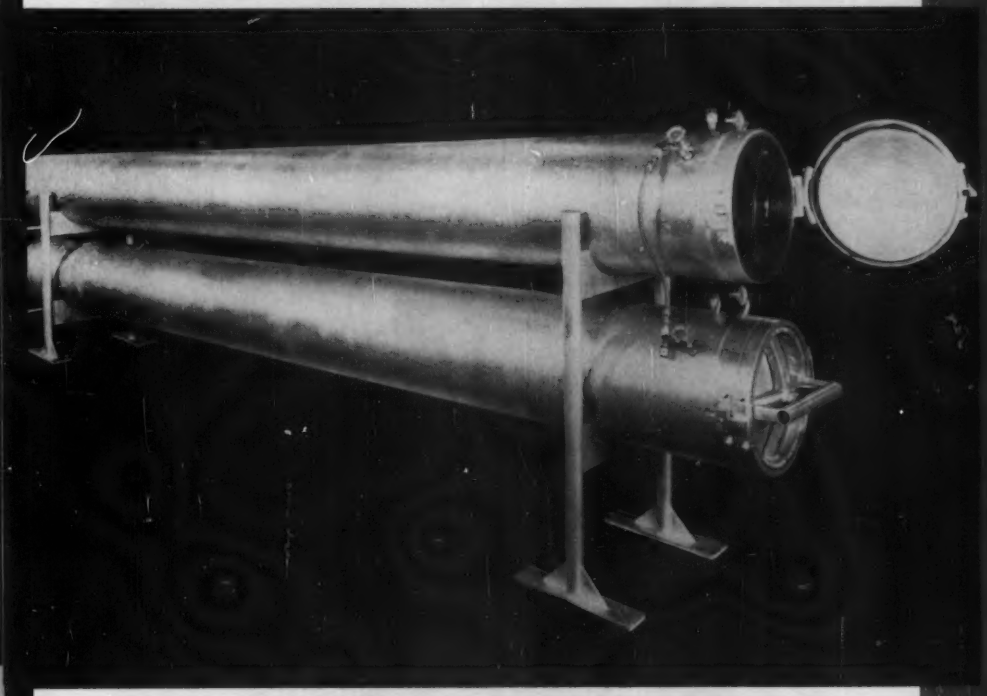

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Dry Ice Converters Are The Most Convenient, Economical Source for Carbon Dioxide . . .

- **USED BY LARGEST ELECTRIC POWER COMPANIES IN THE UNITED STATES**
- **ELIMINATE HAZARDS OF MOVING GAS CYLINDERS IN AND OUT OF PLANT**
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- **UP TO 75% SAVING OVER COST OF GAS FROM CYLINDERS**

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Installations can be made vertically or horizontally any place that is convenient to plant layout, and with pressure regulator at converters, can be connected by low-pressure piping to locations of use. Thus the installation is permanent, and the hazard of handling high-pressure gas cylinders in your plant is eliminated.

Already in use in the largest electric power companies in the U.S.A., Dry Ice Converters have proved their worth by being re-ordered for use with added facilities. Plant executives have found that: besides the convenience and safety advantages offered by Dry Ice Converters, they can save up to 75% on CO_2 cost because dry ice in commercial quantities offers such a substantial price advantage over cylinder gas.

●

For further information on the applications of Dry Ice Converters to electric power company use, write or wire.

DRY ICE CONVERTER CORP.
TULSA, OKLAHOMA

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DEPT. W BOX 1652, TULSA, OKLA.

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J-M Transite® Ducts install fast to last... give complete cable protection.

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Johns-Manville Asbestos Transite Ducts can be laid directly in trench without concrete envelope or other mechanical protection.

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Made of Asbestos-Cement

J-M Conduit for direct buried banks and exposed runs
J-M Korduct® for concrete banks

YALE

ZEPHYR

means faster handling of 1,000 lb. loads with less effort

Capacity: 1,000 lbs.
Frame width: 18"
Lift: 2"
Ground clearance: 1¾"

The lightweight, rugged Yale Zephyr is a push or pull hand lift truck—specifically built to speed handling of lighter loads which cannot be moved efficiently by hand. Its compact design allows the Yale Zephyr to work in narrow aisles and crammed quarters with amazing speed and ease. A single-action treadle controls lifting and holds the load. Depressing the treadle will not lower the load until the operator pulls the handle into position for balancing the weight of the load—an extra safety feature. A rubber-tired caster front wheel that rotates on roller bearings with a double race bearing swivel makes steering easy, speeds handling and cuts operator effort.

For complete information about the Yale Zephyr or other Yale Hand Trucks in capacities from 1,000 to 12,000 lbs., write The Yale & Towne Manufacturing Co., Philadelphia 15, Pa., Dept. A-1279.

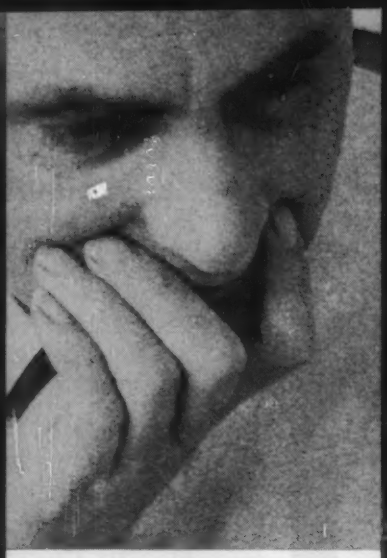
To meet the need of expanding industries for better materials handling methods, look to Yale for advances in research, engineering, manufacturing, sales, service—as

YALE BUILDS FOR THE NEW ERA

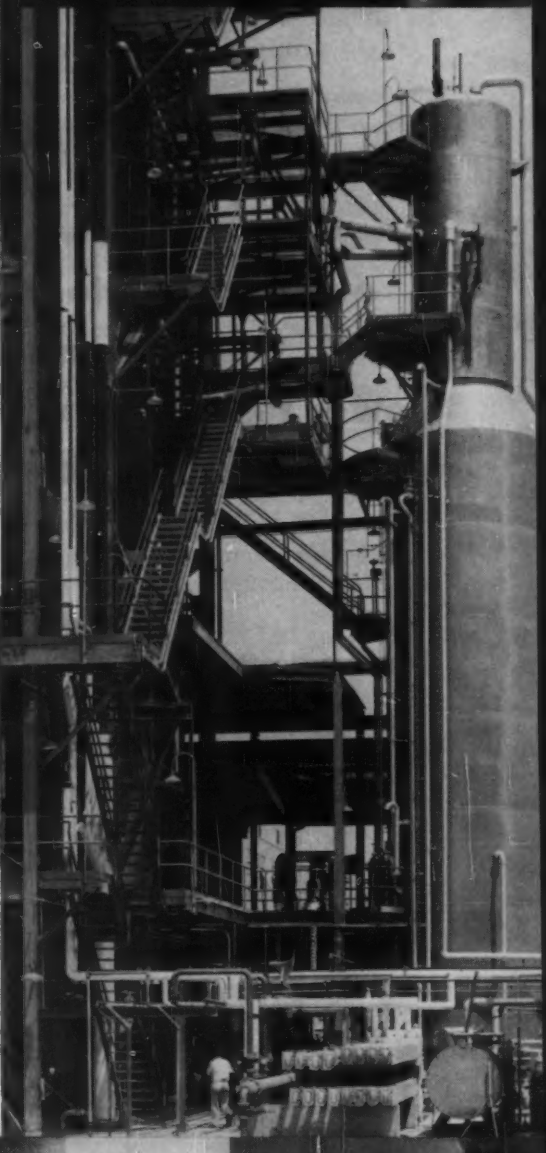
YALE* INDUSTRIAL LIFT TRUCKS AND HOISTS

*REG. U. S. PAT. OFF.

Gasoline, Electric & LP-Gas Industrial Lift Trucks • *Worksavers* • Warehousers • Hand Trucks • Hand and Electric Hoists



WHEN you consider expansion . . .
. . . the most important
investment you can make is in
the creative ability of men.



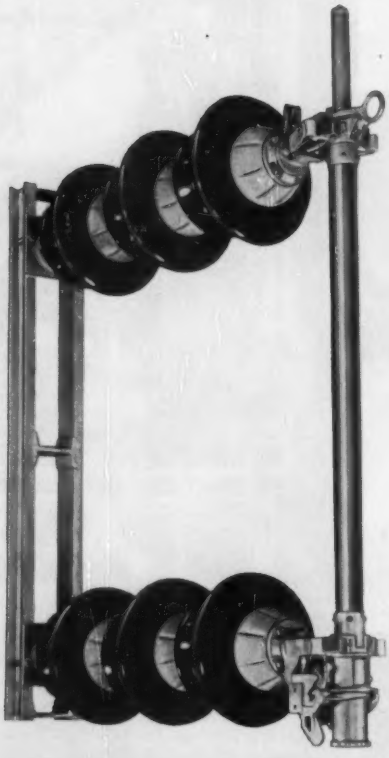
FLUOR

The Fluor Corporation, Ltd
Engineers & Constructors
3500 S. Atlantic Blvd., Los Angeles

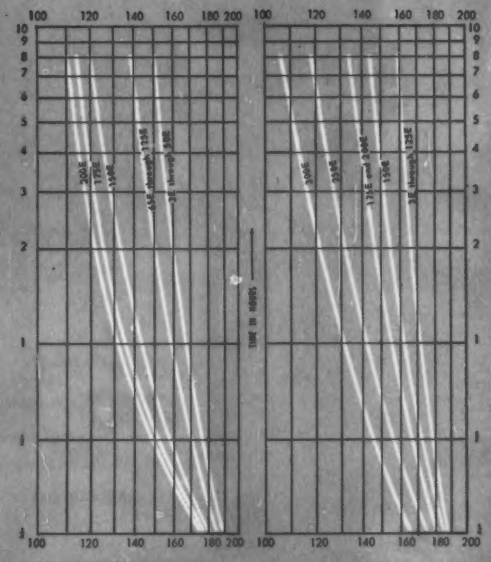
→

Completed 40 days ahead of schedule this new 60,000 KW steam electric unit at San Bernardino is producing profits for California Electric Power Company.

now... even for overloads you can match power fuses to power transformers



short-time emergency overload capability for SMD Power Fuses



Load Current in Per Cent of SMD-1 Fuse Unit Ampere Rating

Load Current in Per Cent of SMD-2 Fuse Unit Ampere Rating

The pressure is on to obtain maximum utilization of power transformer capacity. This pressure has led to precise evaluation of transformer short-time overload capabilities—for both daily peaks and occasional emergencies.

To keep pace, S&C has made correspondingly precise evaluations of the overload capabilities of its power fuses.

The result: (1) New fusing tables (minimum ampere rating recommendation) which recognize short-time daily overload and (2) new curves (see above) which permit you to subject power fuses to extreme short-time overload during emergencies, as when one transformer picks up the load of another.

All of this is part of a new method for power fuse selection contained in a 16-page package—Data Bulletin 262. For your copy, write to S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

S&C ELECTRIC COMPANY

NEWS-SCOPE

FUTURE NEWS ▶ **Edison Electric Institute will soon know** some of the industry's residential lighting sales roadblocks. Questionnaires from EEI's newly formed Home Lighting Policy Committee have gone out in an attempt to analyze present promotional methods on lighting.

Electric utilities will intensify their efforts in 1958 to sell free enterprise at the grass roots in their own communities. Object: To offset the apparent lack of interest among the general public uncovered by recent surveys.

Interest soon will grow sharply in promoting applications of electric heat in commercial and industrial establishments.

LATE NEWS ▶ **The first federal atomic insurance act becomes law** as President Eisenhower's signature ends the long standing controversy. The new law provides for up to $500 million of government insurance against damages from accidents in private atomic power plants.

Despite a threat by Robert Moses, upstate New York officials have refused to withdraw their request for an FPC hearing on construction details of the Niagara project. Moses, New York Power Authority chairman, threatened to postpone ground-breaking ceremonies on Sept. 12 if objections to certain construction plans are not withdrawn.

AEC receives a proposal for a 17,000-kw nuclear power reactor from the Carolinas Virginia Nuclear Power Associates. CVNPA, comprised of four utilities, proposes a heavy water moderated, heavy water cooled, slightly enriched uranium reactor. No site has been named.

Kansas City Power & Light Co strike ends. Union employees voted Sept. 1 to accept state seizure by acting Gov E. V. Long of Missouri under the King-Thompson law. Negotiations on wage settlement were resumed Sept. 3. Unions were asking for 7¼% hike. Company was offering 5¼% when negotiations were broken off on August 23.

Electric utilities have about $100 million a year rate increases in the hopper at present. The largest is Southern California Edison Co. It is asking for $34 million more per year with Commonwealth Edison requesting $25 million and Pacific Gas & Electric asking $16 million.

A package wage offer of more than 20¢ an hour is rejected by about 180 UWUA members at the Stanton station of Pennsylvania Power & Light. Members have instructed Pres R. J. Barrett to request Gov G. M. Leader to appoint a mediator under the Utilities Act of 1947 to effect a settlement of the dispute.

Congratulations . . . Errol W. Doebler succeeds Edward F. Barrett as chairman of the board of Long Island Lighting Co and continues as chief executive officer. John J. Tuohy becomes president and Robert G. Olmsted rises to vice-chairman of the board . . . Arkansas P&L elects Wallace M. Harrell as treasurer to succeed the late James L. Brodie.

ELECTRICAL WEEK

A TWO-MINUTE

WASHINGTON ▶ **Is the rural electrification act out of date** with today's conditions? Things have changed in the last 20 years, and legislators are beginning to ask questions that may become politically explosive in the light of present interest rates and growing rural loads (p 48).

EVENTS ▶ **Cement strike did not "seriously" affect progress on St. Lawrence** power project. Construction is on schedule (p 44) . . . Con Edison marks 75th anniversary of date when Edison threw the switch at Pearl Street station in New York (p 50) . . . Miniature transformers and pole assemblies help Gastonia (N.C.) Water & Light Dept train its linemen . . . Industry gains 1,634-Mw in June (p 54).

CONSTRUCTION ▶ **Florida Power substitutes steel roof decking for plywood** and wood joists as forms for reinforced concrete operating floors in power plants. Overall costs are cut 29% by reduction in labor and waste material even though the decking becomes part of the floor (p 72).

SYSTEM ENGINEERING ▶ **Do you have as much reserve as you think?** Commonwealth Edison's system planning engineer says you may not. He cites two systems of identical capacities and peak loads. Are their average monthly reserves also identical? No; one is 26% and the other is 21%. Summer peak makes the difference. The author says serious thought must be given to terms used to describe reserves, otherwise companies may not realize fully the true meaning of their own reserve figures (p 55).

Gompertz curves are particularly favored as tools in predicting long-range utility growth trends. Their reliability has been demonstrated and they follow a pattern which, when projected, satisfies the classic patterns of growth often seen in economic trends. But human judgment remains the indispensible factor in all planning (p 56).

GENERATION ▶ **New Zealand's volcanic North Island is the center of new geothermal** interest. A 250-Mw power plant to be driven by earth-steam is now under construction. Attendant problems involve steam quality, cooling water (available about 2 mi away), heat flow within the earth, and —unlike exploring for oil — drilling into high temperatures and pressures. The cooling water problem was solved by building the plant near the river and piping steam to it (p 60).

TRANSMISSION ▶ **Tower height is one factor contributing to excessive lightning outages** on two new EHV transmission lines. With a camera in a darkened laboratory, experimentors proved that a 22-ft tower leg will not ground a steep-wave discharge of an impulse generator before insulators, connected in parallel with the leg, flash over (p 62).

METERING ▶ **A new meter for a 3-wire connection from a 4-wire wye,** 3-phase distribution system has been developed. It is a single-stator, single-rotor watthour meter (p 68).

SUBSTATIONS ▶ **Preserving transformer oil is the object of a new seal** which combines a constant-pressure feature with an impermeable, isolating diaphragm between atmosphere and oil in an expansion tank (p 59).

You've got to control circulating current to prevent overheating of load-tap-changing transformers operating in parallel if their voltage ratios wander too far apart. Six methods of doing so are (1) manual control, (2) reversed reactance compensation, (3) cross-current compensation, (4) current balance, (5) electrical interlocking, and (6) mechanical ties. Despite varying situations, you may want to choose one technique for "standard" use (p 64).

EMPLOYEE RELATIONS ▶ **Psychological studies can help you decide who to promote.** Good managers (1) have more mental ability than the general public, (2) possess more "leadership" or "dominance" than the general male population, (3) remain calm under pressure, (4) are quick-thinking, quick-acting, energetic people (p 52).

INDUSTRIAL ▶ **A hot nichrome wire cuts blocks of polyurethane foam** into various contours satisfactorily . . . A new lighting system — which yielded a 600% increase in night-time illumination and up to 300% increase in daytime lighting — has boosted production, employee accuracy and morale for a crane manufacturer (p 89).

SELLING ▶ **Now they're growing oats electrically.** In Texas, using an oat-growing machine, dairy farmers successfully have grown oats eight inches high in six days. The machines maintain ideal 72F temperature and 70% humidity conditions during growth period, plus proper light level. The machines come in 20- and 40-cow herd sizes (p 80).

DEPRECIATION ▶ **Utilities should press for equitable treatment of liberalized depreciation,** persuading commissions it'll benefit customers (p 108).

PEOPLE ▶ **Otto Brunenmeister, Jr, has been named vice president** of Ohio Edison Co while E. A. Ladd moves into the vacated post of comptroller . . . Louis O'Sullivan and Leo Roy have been named commissioner and general manager, respectively, of Quebec-Hydro Electric Commission (p 120).

MANUFACTURERS ▶ **Utility and industrial orders for generating capacity are holding high:** 43,364 Mw were scheduled for shipment as of July 1. This is slightly over 2 million kw greater than on the previous July 1, reports Edison Electric Institute in its interim electric power survey (p 114).

NEW EQUIPMENT ▶ **Frame-mounted OCB's use drop-bar contact structure,** simplified mechanical linkage, and hydraulic operating mechanisms for 23-69-kv services . . . Two butyl-molded potential transformers are made for indoor and outdoor circuits up to 5 kv, replacing four units (p 90).

ENGINEERING TRENDS

Injection of ammonia into boiler combustion gases appears to be an efficient and economical method of eliminating the acid dewpoint and reducing the corrosion of exposed steel surfaces to a negligible amount according to *Combustion*.

Nobium may be used to "can" nuclear fuel elements for the British's fast breeder reactor at Dounreay because of its low neutron absorption, ability to withstand high temperature without creep, and its compatibility with uranium.

Solar space heaters are becoming more attractive with rising house-fuel costs and the introduction of better materials for the space heater such as weatherable plastics, tube-in-strip heat collectors, and low cost insulation.

Greater ease in disposing of nuclear wastes is seen in use of sawdust as the absorbing agent. According to tests conducted in Belgium, handling is simplified and disposal costs reduced.

Transmission tower heights influence lightning flashover rates on high voltage transmission lines.

Forced required to strip a coating from a metal surface can be swiftly, easily, and accurately determined as a result of investigations made by the National Bureau of Standards. In the system used an electronic averaging machine converts variable stripping forces measured by an adhesion measuring device into electronic impulses. These impulses are then added to give a single average value which can be read directly from a standard recorder.

Interior lighting should fulfill designers' dream when plans are built to scale in model structures and tested for lighting distribution with a miniature light cell.

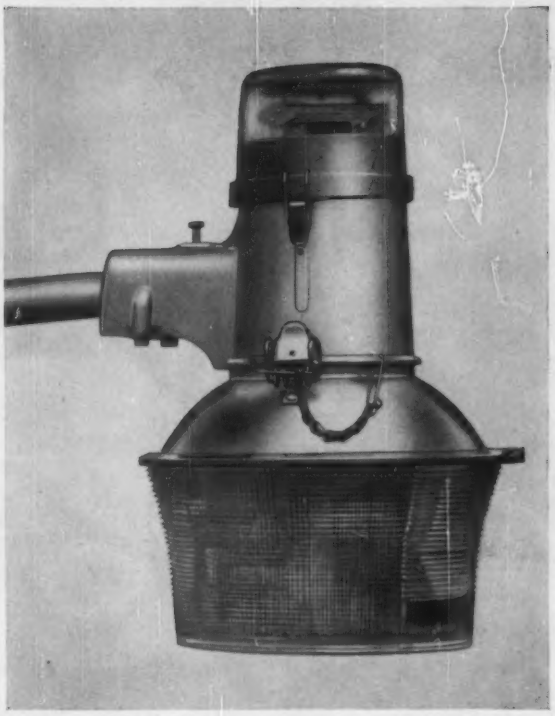
FROM EDITORS IN THE FIELD

Transmission and distribution facilities are designed more accurately for serving large high-usage residential areas with help of residential demand curves compiled by Pacific Power & Light Co. Studies showed that daily demand of space-heating and lighting-and-appliance components produced coincidental peaks: one at 6-11 AM, other at 6 PM. Demand study reveals the larger of the total peaks, which is used for designing T&D facilities.

Promise of a desirable controlled load is offered by an accumulator-type system that stores hot or cold water at night for subsequent electric space heating and cooling. Studies by Western Massachusetts Electric indicate that this system can give occupants all-year comfort at reasonable cost.

L-M Suburbanaire Gives Protection, Adds Off-Peak Load

Utilities rent customers this photocell-controlled luminaire at about $3 a month; it provides all-night lighting for security and recreation; increases revenue for the utility. Open-type refractor keeps maintenance at minimum.



A number of utility companies have had excellent results with a new plan for individual outdoor lighting for customers. Here, briefly, is the plan:

- The utility installs the L-M Suburbanaire on the customer's premises without charge. The Suburbanaire is an open-type, low-cost luminaire with built-in photocell control, thus providing all-night yard lighting.
- The utility maintains the unit and keeps it in operation.
- The utility provides power which does not go through the customer's meter.
- Cost to the customer is a stated amount per month—usually $3 or $3.50—which covers all costs. The utility retains ownership of the luminaire.

Customers like the plan, because it safeguards property, cuts vandalism and theft, reduces accidents, and has some prestige value, particularly in areas where there is no street lighting.

From the utility standpoint, the plan increases revenue in off-peak hours. Here is what some utility men say:

"We have installed more than 200 L-M rural lights, increased our off-peak load by more than 50 kw, and have had many expressions of complete satisfaction from our customers."

"The Photocell Suburbanaire assures us of an off-peak load of about 1000 kw hours per unit. We have installed almost 400 Suburbanaire luminaires, many of these replacing the old makeshift radial fixture arrangement. Customer reaction has been excellent . . . equipment and gasoline theft has dropped substantially and vandalism is almost nil."

"From time to time, customers have asked us for outdoor lighting for rural and suburban homes. Since January, 1957, we have been installing L-M's new Suburbanaire unit. The long-life lamp and photo-electric cell, plus ease in relamping and cleaning the open refractor, will keep our maintenance costs at a very low minimum. This makes it possible to offer this service at a very low cost."

TYPICAL ANALYSIS OF COSTS

Material:	
Suburbanaire, photocell, bracket, etc.	$ 70.00
Installation labor	30.00
Annual power cost (based on 300 watt lamp burning 4000 hrs. per year @ 1¢ kwh)	12.00
Lamp replacement, maintenance	9.00
Total Cost First Year	**$ 121.00**
Outdoor lighting equipment is built to last 20 to 25 years, but if this equipment is amortized over 10 years, the cost will be:	
First-year cost (above)	$121.00
Nine times power and maintenance cost (9 more years) 9 x ($12 + $9)	189.00
10-year total	$310.00
Interest at 6%	18.60
Profit, at 10% on $328.60	32.86
Total 10-Year Cost Plus Profit	**$ 361.46**
Annual cost (1/10th)	$ 36.15
Cost per month (1/12th)	$ 3.01

Get The Whole Story

Ask the L-M Field Engineer for bulletin on the L-M Suburbanaire luminaire and more information on the profitable customer-rental plan. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

316

LINE MATERIAL Industries Outdoor Lighting

McGRAW-EDISON COMPANY

EACH LINE MATERIAL TRANSFORMER is issued an IBM card upon which are placed all test results and reference information pertinent to the unit. Cards are microfilmed as a permanent record.

How L-M's Quality-Control System Insures High Transformer Standards

By **ROBERT P. THOMPSON**
Manager of Engineering
Transformers
Line Material Industries

Performance characteristics of L-M Round-Wound® transformers are outstanding. Physical features are exceptional. Quality is *built in* to L-M transformers, not tested in. To make doubly sure of maintaining uniformly high quality, L-M has established a very tight quality-control system.

Continuous tests are made—from raw materials to finished product. A final assurance of quality is the permanent microfilmed record of test information kept on every L-M transformer.

CORE TESTING: The tolerance permitted in testing the bare core of L-M's Round-Wound transformer is much more stringent than required by NEMA and ASA of core performance in the completed transformer.

The specially trained craftsmen who make Round-Wound transformers take pride in the high quality of their work—no small contribution to the continued excellence of Round-Wound transformers and their amazingly low failure rate—less than 2/10 of 1 percent!

Check on Incoming Materials

All raw materials and parts for L-M Round-Wound transformers are rigidly and systematically inspected. For example:

- Every high-voltage porcelain bushing is subjected to acceptance dielectric tests.
- Samples of all wire are tested for resistance and cross-section uniformity; coating is tested for dielectric strength, adherence, thickness.
- The cold-rolled oriented silicon steel used in making L-M's wound core is tested for physical and magnetic characteristics by means of a precision Epstein tester. Rigid standards on the loss and permeability characteristics are maintained.

In-Process Tests

A continuous "in-process" testing and inspection program is followed throughout the plant. Cores are tested for magnetic characteristics before and after copper coils are wound upon them. Coils are checked for ratio and given a mechanical inspection immediately after being wound. All finished units are thoroughly tested for leaks.

COIL RATIO TEST: Ratio and polarity are checked immediately after the coil is wound, so as to maintain close surveillance of the coil-winding operation at all times.

When the unit is completed, every transformer is given a complete series of electrical tests in strict conformity with NEMA and ASA standards. These tests include core loss and excitation current, copper loss and impedance, ratio, induced voltage, high potential, polarity, and impulse.

Certificate of Test

Each transformer is issued an IBM card which follows the unit through to completion. The card provides space for all test results. It is punched or filled in at each inspection and test station if, *and only if*, the transformer satisfactorily meets all the requirements of NEMA standards and of the L-M engineering and quality-control departments.

When the transformer is shipped, the cards are microfilmed and then stored to provide actual test data throughout the life of the transformer. This complete test information can be furnished to you at any time on any transformer.

Compare L-M's high standards of performance and outstanding physical features with other transformers; you will see why more customers are specifying L-M Round-Wound transformers.

Get Complete Information

Ask your L-M Field Engineer for complete information on the outstanding performance characteristics of L-M Round-Wound transformers and on L-M's unique obround tank. Or write Line Material Industries, Milwaukee 1, Wisconsin.

LM® **LINE MATERIAL Industries**
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON

CLARK Type "CY" Starters, sizes 0 and 1, now have higher NEMA horsepower ratings

As shown in the table below, NEMA maximum horsepower ratings for size 0 and 1 AC magnetic across-the-line starters have been increased. Clark Type "CY" starters now available to meet these new standards will, in many cases, permit you to meet your requirements with smaller sizes. You can at once take advantage of the money and space savings made possible by this re-rating.

CHANGES IN NEMA STANDARDS FOR MAXIMUM HORSEPOWER RATINGS OF AC MAGNETIC STARTERS AND CONTACTORS

SIZE AND VOLTAGE RATINGS	MAXIMUM HP RATINGS	
THREE PHASE	OLD	NEW
Size 0 110V	1½	1½
Size 0 208/220V	2	**3**
Size 0 440/600V	3	**5**
Size 1 110V	3	3
Size 1 208/220V	5	**7½**
Size 1 440/600V	7½	**10**
SINGLE PHASE		
Size 0 110V	1	1
Size 0 208/220V	1½	**2**
Size 0 440/600V	2	**3**
Size 1 110V	1½	**2**
Size 1 208/220V	3	3
Size 1 440/600V	5	5

NOTE: HP ratings for plugging and jogging duty have not been revised.

IN ADDITION TO COST AND SPACE SAVING BENEFITS OF THE NEW NEMA RATINGS, CLARK Type "CY" STARTERS OFFER MANY OTHER ADVANTAGES:

Greater Dependability and longer life

- Heavy-duty mill-type construction.
- Large silver-to-silver twin-break contacts.
- Vertical lift, free-floating magnet uses no springs; pull characteristic assures positive contact closing and keeps magnet slam to a minimum.

Easier Maintenance

- Contacts and contact springs quickly and easily inspected—without tools.
- All parts readily accessible and replaceable from front without removal from panel or enclosure—screwdriver and wrench only tools needed.
- Magnet coils easily replaced.

Simplified Installation

- Generous wiring space.
- All terminals face the front.
- Pressure-type terminals line and load.

...and many others

These increased horsepower ratings for AC controls will be adopted for all forms of Clark across-the-line starting equipment.

Revised Clark Catalog sheets and price lists covering the new NEMA ratings are available on request.

The **CLARK CONTROLLER** *Company*

Everything Under Control — 1146 East 152nd Street • • Cleveland 10, Ohio

IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO

NOW TRANSISTORIZED

power supply *speaker* *microphone*

MOTOROLA T-POWER 2-WAY RADIO

Improved Performance with Lower Operating Cost

Already famous for the lowest maintenance and operating costs in the mobile 2-way radio field, Motorola radio is an even better investment now—with T-POWER. The vibrator is gone! . . . replaced by rugged, long life transistors. Reduced "down-time", lower maintenance, and greatly improved performance *all* result from this new development. The transistorized POWER VOICE Speaker is 10 times more powerful than conventional speakers . . . talks *through* noise and can be heard hundreds of feet away from the vehicle. The transistorized Dynamic Microphone gives unprecedented voice clarity and greater communications range.

New Mounting Flexibility with Plug-In Control Head . . . Same Basic Unit can be Used for Front or Trunk Mounting

With the T-POWER radio you are no longer restricted to one type of mounting. Install the complete radio, with drawer unit and plug-in control head, for under-dash mounting. For rear mounting, the same basic drawer unit can be installed in the trunk and connected by cable to a dash-mounted control head. And—the same basic drawer unit can be interchanged with the equivalent Motorola Twin-V trunk mount models operated from a 12-volt negative ground source.

Get all the facts. Write now for literature with complete information.

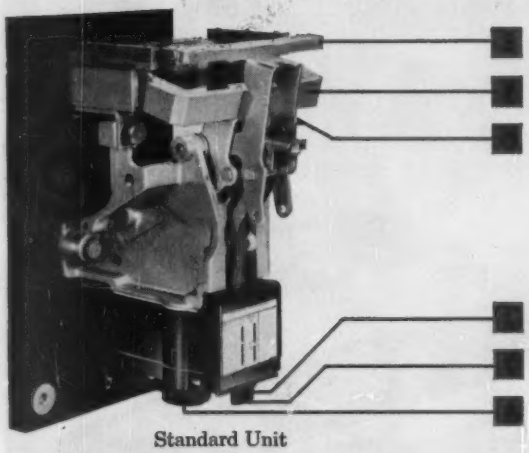
MOTOROLA TRANSISTOR POWER 2-WAY RADIO
T POWER

Transistorized Power Supply for receiver and 25-watt transmitter.

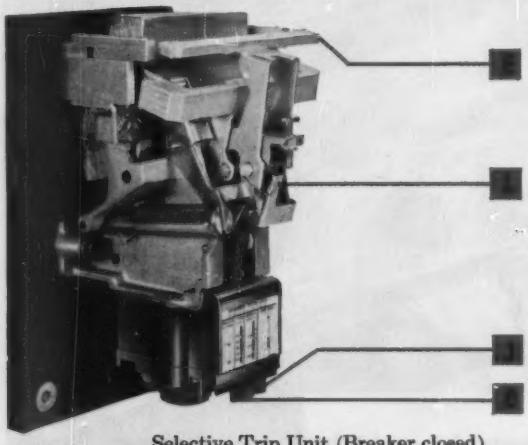
MOTOROLA Communications & Electronics, Inc. · 4501 Augusta Blvd., Chicago 51, Illinois · A Subsidiary of Motorola, Inc.

75,000- and 100,000-ampere I. C. breakers with*

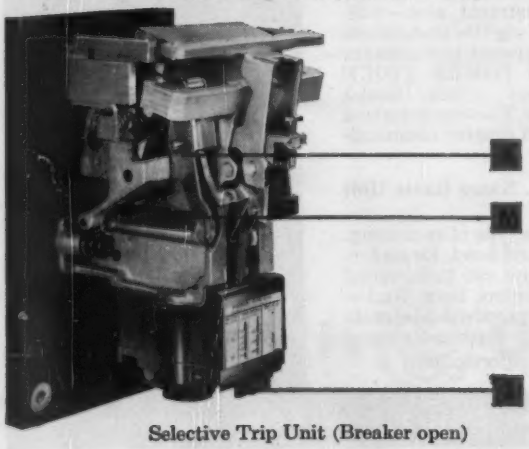
SELECTIVE TRIPPING THAT REALLY SELECTS



Standard Unit



Selective Trip Unit (Breaker closed)



Selective Trip Unit (Breaker open)

True, selective tripping in these DB-75 and DB-100 low-voltage breakers eliminates the necessity that they *ever* close against a fault. The resulting lower closing energy means:

Less mechanical duty on all moving parts.
Less maintenance.
Lower energy drain on electric closing source.

Selective unit returns breaker characteristic to intentional short delay required for selectivity with other breakers, immediately after breaker latches. It does *not* impair the breaker's ability to close against overloads up to ten times the trip unit rating—motor starting, for instance.

All this is accomplished by a simple piston-delayed latch which converts the short-delay trip to instantaneous trip when the breaker is open—and re-establishes the short-delay feature approximately one second after the breaker is latched closed.

Note these features:
*Standard trip unit**
***Interrupting capacity 75,000- and 100,000-ampere breakers with**

A. Long-Delay Adjustment
B. Long-Delay Pickup Adjustment
C. Instantaneous Pickup Adjustment
E. Instantaneous Armature
F. Long-Delay Armature
G. Tripping Knob

Only these additions to provide *selectivity with all the above advantages*

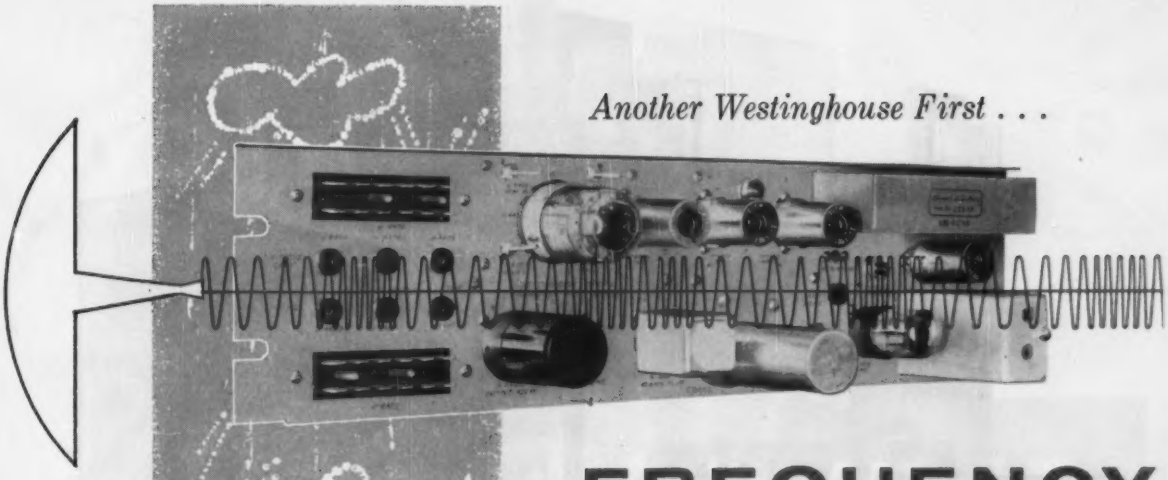
A. Long-Delay Adjustment
B. Long-Delay Pickup Adjustment
E. Short-Delay Armature
F. Long-Delay Armature
G. Tripping Knob
I. Short-Delay Pickup Adjustment
J. Short-Delay Time Adjustment
K. Roller Lever
L. Discriminator Latch
M. Reset Spring and Air Piston

***With standard trip units these breakers are rated 100,000 and 150,000 amperes I. C. at 240 volts a-c.**

Your nearby Westinghouse sales office has all the details, or you may write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60916

YOU CAN BE SURE...IF IT'S

Westinghouse



Another Westinghouse First . . .

FREQUENCY SHIFT

The First Multiplex Panel Designed Specifically for Protective Relaying

Distance relaying, remote and transfer-trip operations by microwave radio reach their reliability peak with the combination of Westinghouse FR microwave and FJ frequency shift equipment.

Using a crystal controlled oscillator and 500-cycle frequency shift prevents high random noise from causing false breaker operation.

All circuitry is cascaded to "fail safe." Any component or tube failure which could prevent a necessary trip will automatically give an alarm. Tube failures cannot cause false trip operations.

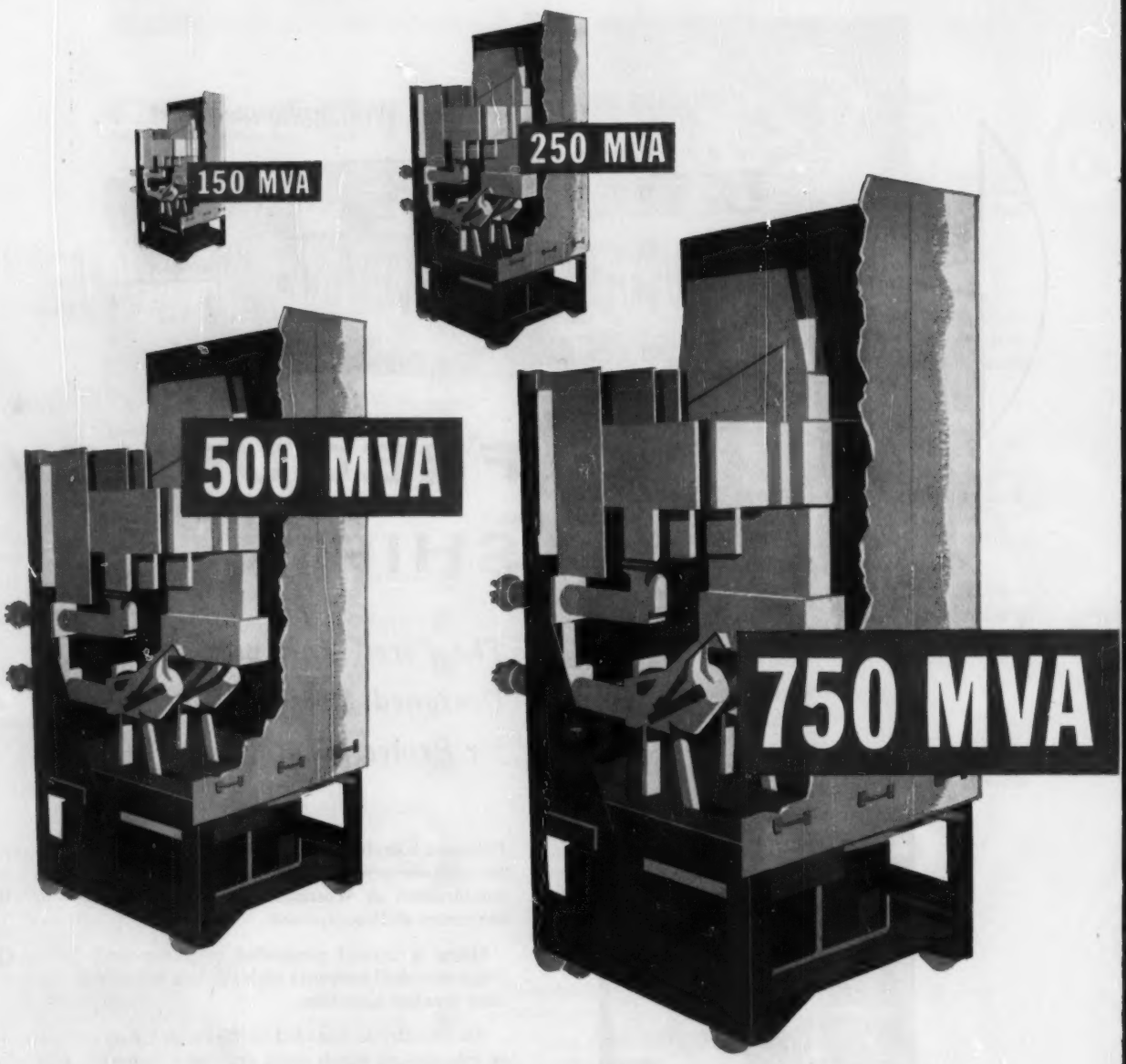
The shift is accomplished by a high-speed magnetic keyer, hermetically sealed for long life. It is isolated to permit direct connection to battery circuits without the use of interposing relays. Similarly, the receiver relay can be connected directly to the breaker trip coil.

Get the details and specifications from your Westinghouse sales office or request DB 83-543 from Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-60915

YOU CAN BE SURE... IF IT'S

Westinghouse



Westinghouse paces industry
by introducing the

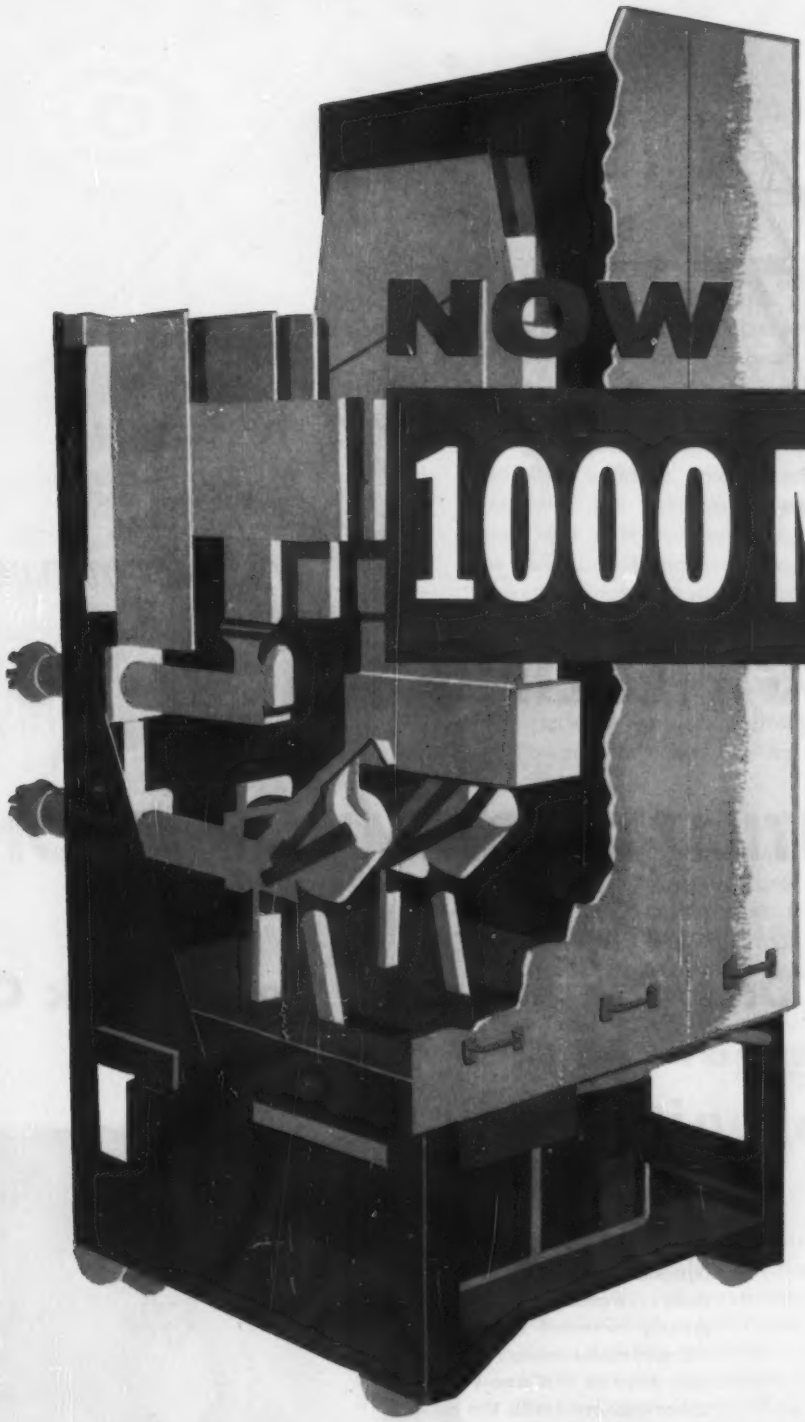
WORLD'S FIRST MAGNETIC CIRCUIT BREAKER TO INTERRUPT 1 MILLION KVA FAULT

1200 and 3000 continuous ampere capacity

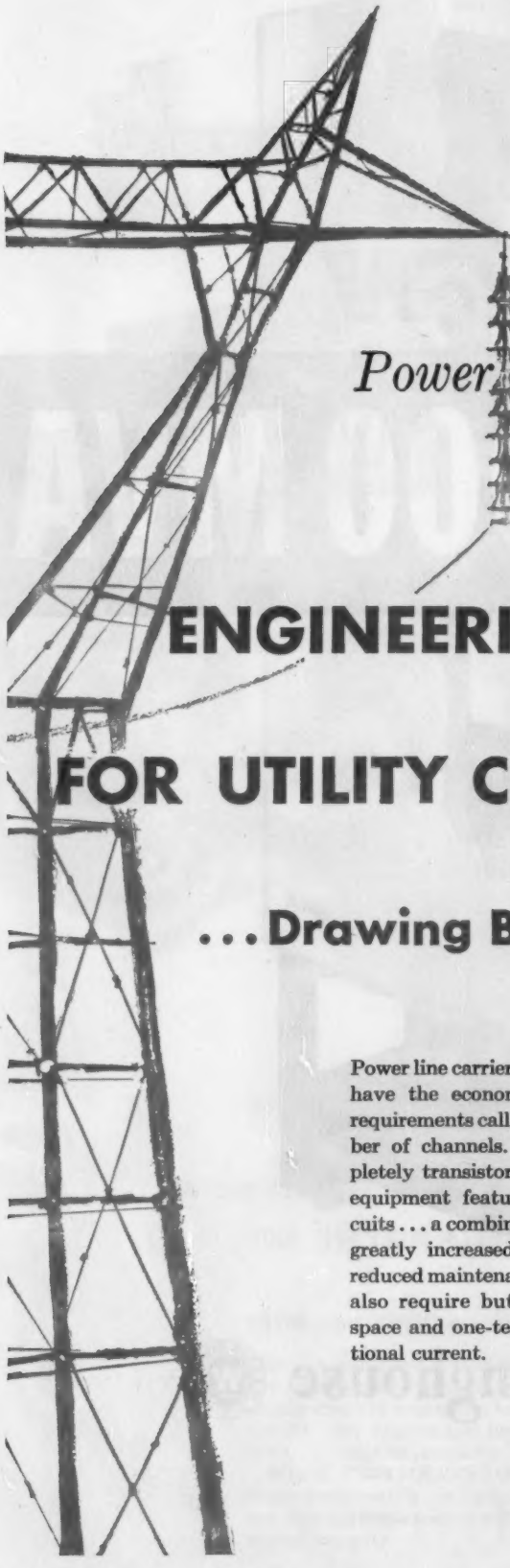
The time-tested and proven design of the De-ion principle of circuit interruption has again lent itself to increased capacities. Westinghouse engineers, constantly aware of your needs, have now adapted the De-ion principle to the new 150 DH 1000 breaker that interrupts faults up to the magnitude of 1 million KVA . . . highest magnetic breaker interruption capacity in the industry!

WHAT THIS MEANS TO YOU: It means you'll be better able to handle larger loads—safely—in large metropolitan generating substations. It means, too, that greater economy will be realized in utility and industrial substations of high capacity.

J-60926



YOU CAN BE SURE...IF IT'S Westinghouse



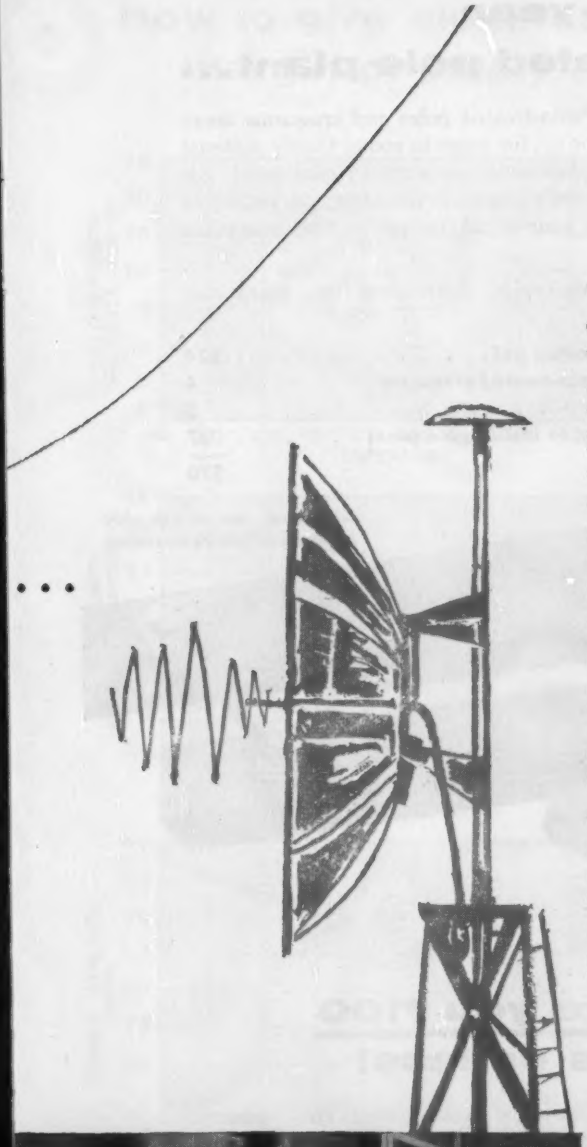
Power Line Carrier.....

or Microwave....

ENGINEERING KNOW-HOW FOR UTILITY COMMUNICATIONS

...Drawing Board to Final Check Out

Power line carrier systems usually have the economic edge where requirements call for a small number of channels. The new completely transistorized KR carrier equipment features printed circuits... a combination that spells greatly increased reliability and reduced maintenance. These units also require but one-twentieth space and one-tenth the conventional current.



Westinghouse is in a unique position to counsel you on the utility communications system best suited to your requirements . . . be it carrier or microwave . . . for automatic operation, control or protection of your system. No other organization has the depth of experience in planning, designing, building, erecting and maintaining communication systems for electric utilities that you'll find at Westinghouse. Our background in the basic utility industry provides excellent insight to your operational problems.

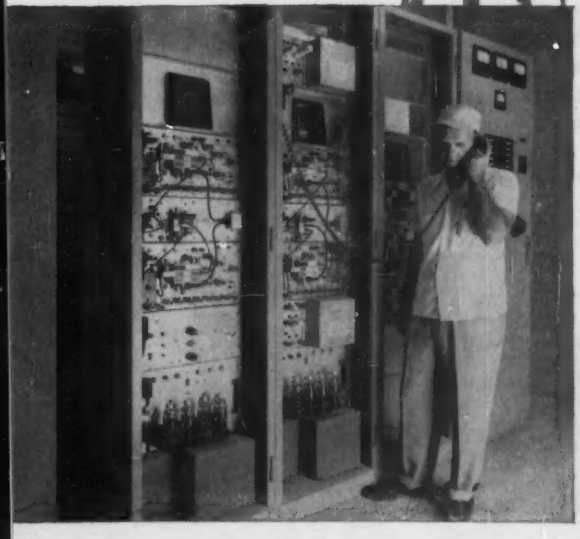
Whether your problem is protective relaying, voice communication, telemetering, supervisory control, data processing or VHF control . . . Westinghouse can design, build and install the *one* system best suited to your individual requirements.

For complete details about the capabilities of both carrier and microwave systems, their relative costs and applications, call your local Westinghouse sales engineer. Or write direct to Westinghouse Electric Corporation, Carrier-Microwave Department, Halethrope, Maryland.

J-60929

YOU CAN BE SURE...IF IT'S

Westinghouse



Microwave systems provide complete control of your vital communication functions. Where distances are great or channel requirements are large, they have the advantage of lower cost. Thirty or more duplex voice channels available — several hundred telegraph circuits. Microwave Radio provides the best reliability and privacy of all radio systems.

This $2-a-year Penta-treated pole plant...

Clean, easy to handle Penta-treated poles *and* crossarms mean economy all along the line... for years to come! Costly material and labor charges for replacements are virtually eliminated. Because of Penta-treated wood's long-term resistance (35 years!) to decay and termite attack, your actual cost per year per pole plant is very small.

Let's take a look at this typical distribution pole plant cost breakdown*:

35′ Class 5 Penta-treated pole	**$24**
3¼″ x 4¼″ x 8′ Penta-treated crossarm	**4**
Hardware	**5**
Labor and equipment to install pole plant	**37**
	$70

OR, $2 per year per pole plant based on a 35-year life expectancy.

...Can save you $100 in 10 years or less!

Crossarms as well as poles should be Penta-treated. Then crossarm life will match treated pole life. Untreated crossarms usually must be replaced within ten years or less. Installing a Penta-treated crossarm in the first place will save the entire cost involved in removing and reattaching transformers, capacitor racks, etc. These factors considered, replacement costs could well exceed $100—*actually more than the cost of the entire pole plant itself!* For maximum economy, specify Penta for your *whole* pole plant.

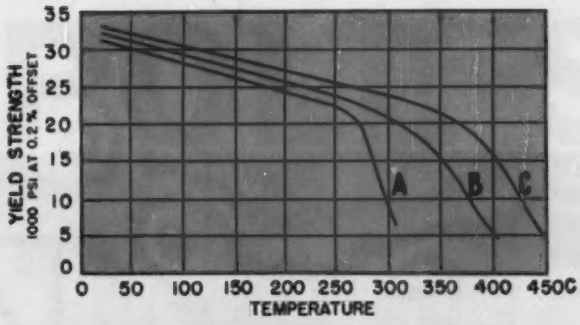
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. PI-14, 800 N. 12th Blvd.
St. Louis 1, Missouri

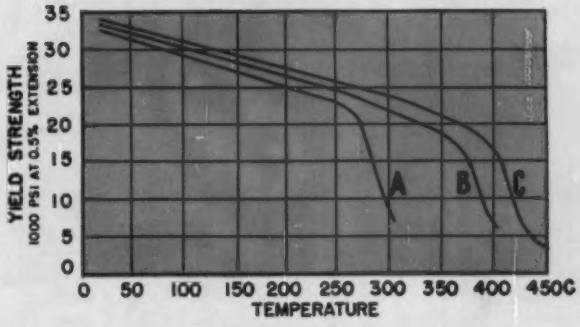
MONSANTO®

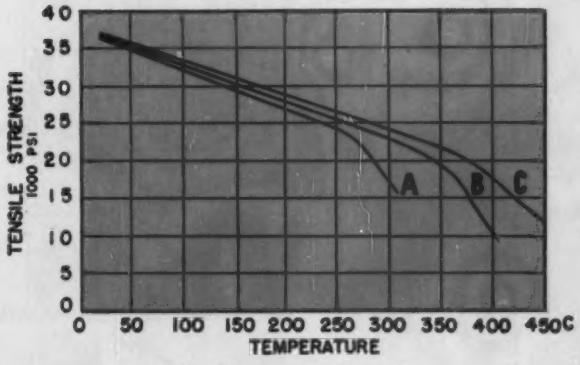
WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

**Average estimated costs.*

How to give electrical conductors an improved margin of safety at elevated temperatures







A. Silver content normal
B. Silver 8.7 ounces per ton
C. Silver 28. ounces per ton

Copper strips cold rolled,	0.050 ins. gage
Time to heat, approximately	1¼ hours
Time of test at heat, approximately	¼ hour
Speed, testing machine head,	0.01 ins. per min.

American Brass Company Metallurgical Research Laboratory 1954

Tests show influence of silver on tensile properties of high-conductivity copper at elevated temperatures

Silver-bearing copper is used extensively in windings, collector rings, and commutators of motors and generators, in order to retain structural strength at elevated temperatures during assembly and operation.

There are now many other places where electrical conductors must stand up under temperatures well above those heretofore considered normal.

The amount of silver needed to meet a particular set of conditions, however, has until recently been difficult to determine. At the left are charts summarizing the results of tests made in The American Brass Company Metallurgical Research Laboratory, which can help serve as a more precise guide.

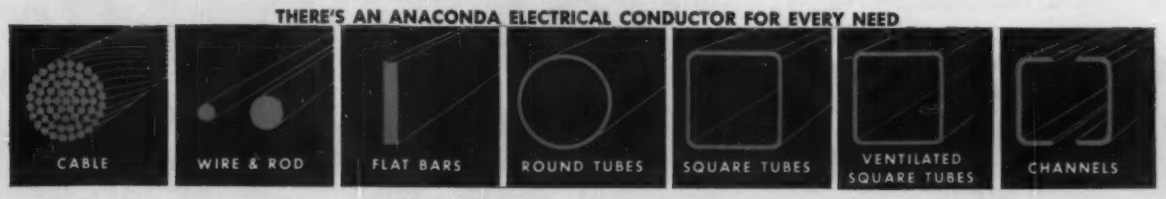
The curves for the yield strengths at 0.2 per cent offset and 0.5 per cent extension are significant to electrical engineers with problems involving the operation of conductors at elevated temperatures, for these values are indices of the limits of elastic behavior. The drop in absolute values of the tensile properties of all three coppers with rising temperature, however, should be noted and be allowed for in the selection of shape and size of conductors that are expected to run hot.

For more complete information on the effect of temperature on the mechanical and electrical properties of copper, send for a copy of Publication C-25, "Anaconda Copper for Electrical Conductors." This 62-page book also has a wealth of other general information, plus convenient new tables to help you in the selection of rigid bus conductors.

Technical Service. The assistance of Anaconda specialists in the selection of conductors to meet your special problems is available to you. For such assistance—or to get a copy of "Anaconda Copper for Electrical Conductors"—see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 57301

ANACONDA®
COPPER CONDUCTORS
Made by The American Brass Company

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



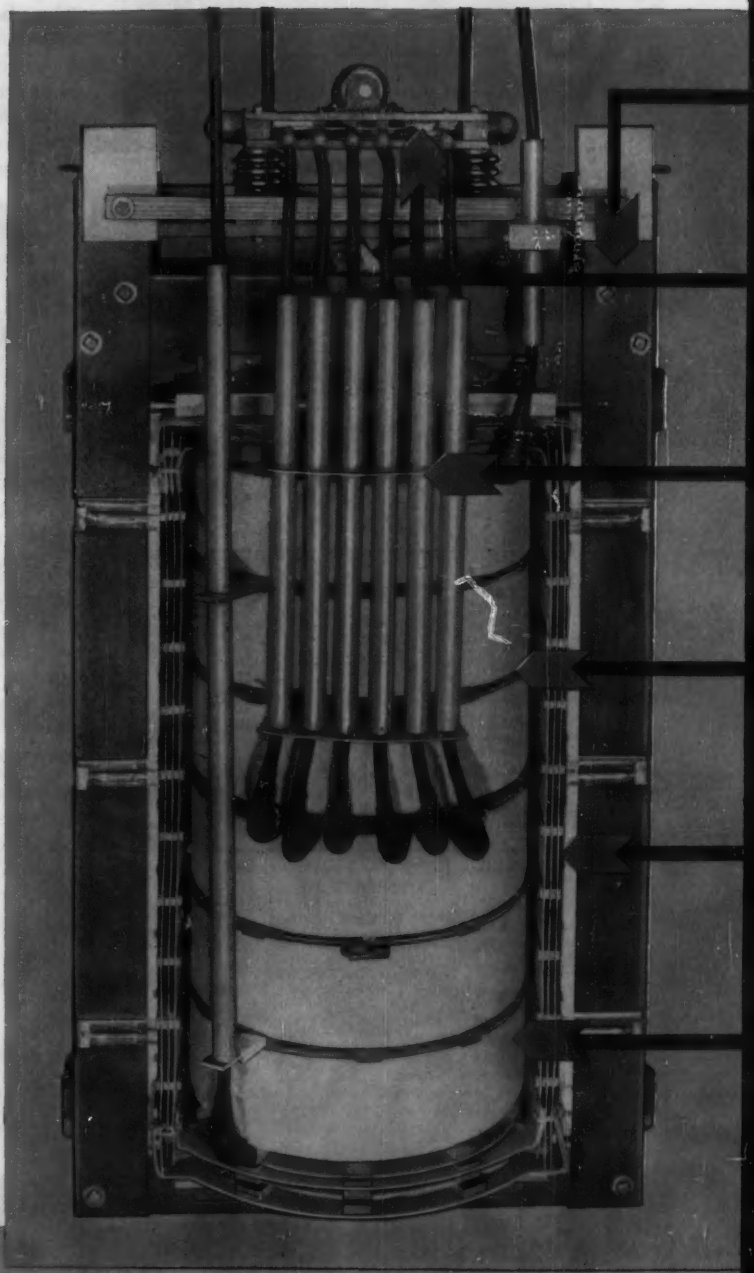
Internal Ruggedness...

POLE STAR

As a general rule, the higher the voltage, the more essential it is that transformer service be continuous and trouble-free. This is true from the standpoint of economics as well as that of customer satisfaction . . . and it is why Pennsylvania gives you *extra* ruggedness where it counts the most, in high voltage Pole Stars.

Take a look at the interior design features shown on these pages and see for yourself. From the patented lap-on-top core to little noticed lead supports, Pole Stars are designed and constructed to deliver *sustained performance* in every type of transformer installation. You can rely on Pole Stars for long range economy and dependability throughout the complete range of EEI-NEMA ratings: through 500 kva, through 67,000 volts, single phase. Pennsylvania Transformer Division, McGraw-Edison Co., Canonsburg, Pa.

The unit pictured is 500 kva. High voltage: 67,000 volts. Low voltage: 7560/13,090Y volts. Construction features shown may vary somewhat in other voltage classes.



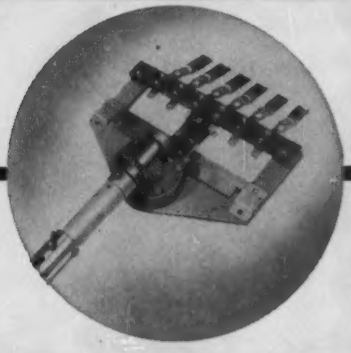
PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA

key to sustained performance of high voltage

POLE STARS

ANGLE-AND-CHANNEL CORE FRAME



Core-and-coil assembly is supported by a sturdy, pressed steel, angle-and-channel frame, which is securely fastened together by bolts with permanently positioned nuts.

STRAIGHT-LINE TAP CHANGER

Straight-line tap changer is of same rugged design as that featured for years on Pennsylvania Power Transformers. Sintered silver-nickel contacts possess electrical qualities of silver and wearing characteristics of nickel.

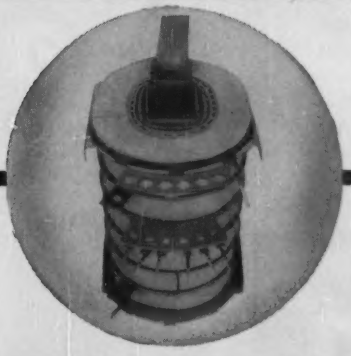
INTEGRAL LEAD SUPPORTS

High voltage leads are insulated in pressboard tubing and held firmly in position by supports that are an integral part of the coil.

LAP-ON-TOP CORE

Core features Pennsylvania's patented lap-on-top construction. Laminations are individually lapped, creating a large cross-section area at lap that reduces density and prevents concentration of flux. Absence of gaps or butt joints assures low exciting current.

INSULATION AND BRACING

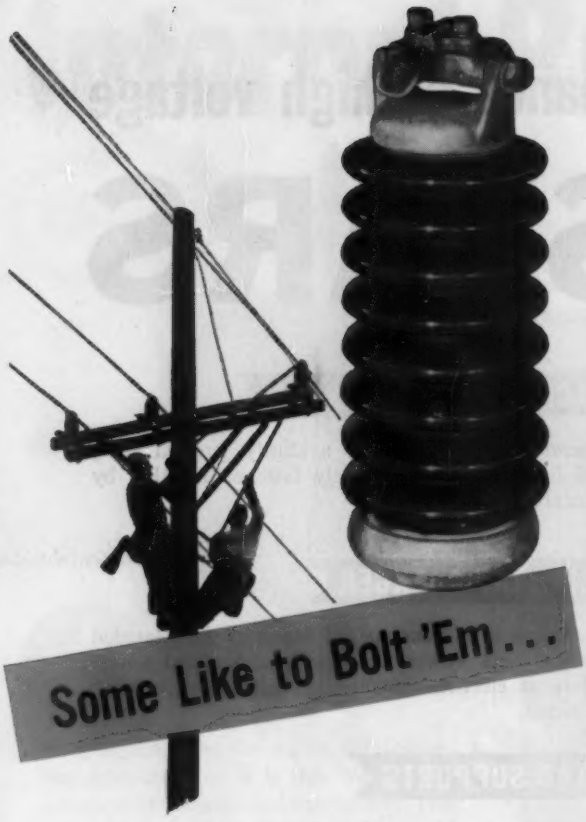


Coils are "packed out" with insulation to securely lock core and coil together. Maple braces provide extra support at top and bottom and help to protect against possible short circuit forces.

SECTIONAL COIL

High voltage windings are sectional, with low voltage layer windings inside. Use of sectional coils in higher voltages improves insulation . . . permits weight and size reductions. Also results in uniform distribution of impulse voltage and greater resistance to short circuit.

DISTRIBUTION TRANSFORMERS

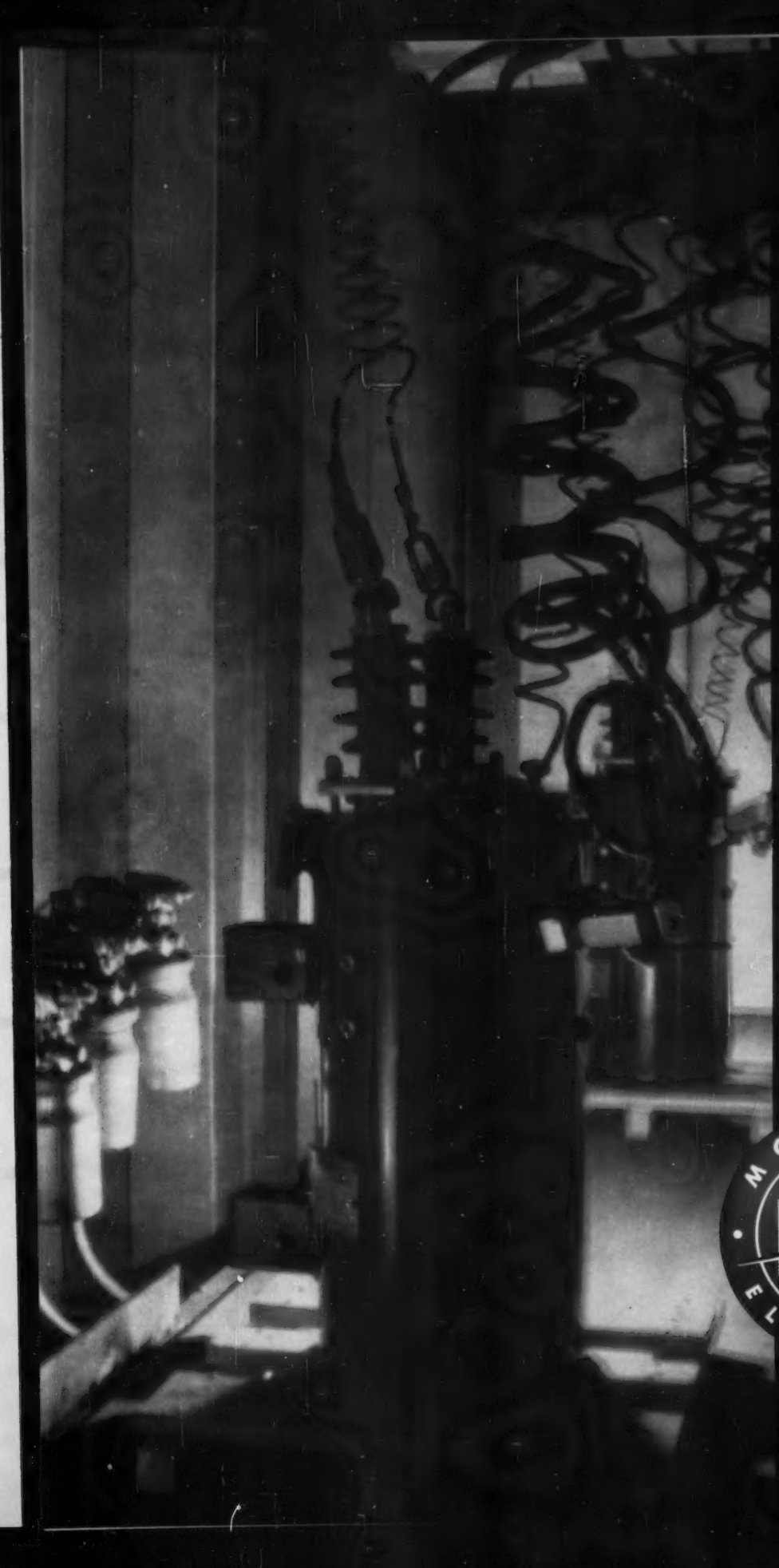


Tie it . . . clamp it . . . the conductor carries the current, but the *porcelain* insulates it from ground. Lapp builds the Line Post with either type of conductor head for maximum convenience of installation . . . and it builds the *porcelain* to do the *insulating* job. The porcelain in either case is a closed-end post, of high density vacuum-process electrical porcelain. It won't puncture because it has no conductive material within it. It outperforms any other type of insulator in dirt conditions because its fog-type design prevents leakage flashover from non-uniform leakage resistance. It stands up under arcover, stones and bullets because its short, sturdy petticoats protect the body. And it won't crack because its hardware, both top and bottom, is *externally* attached, and can load porcelain only in compression.

With tie-wire or clamp-top, the Lapp Line Post will give you an *extra* margin of operating security, low upkeep, long life.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp



Bulletin No. H307-257

AUTOMATIC TESTING

Every transformer "Quality Proved." Yes, Moloney's *Automatic Testing Equipment* assures that every single transformer that comes off the production line is ready to go up on the pole and start giving long, trouble-free service.

MOLONEY ELECTRIC

FACTORIES AT
ST. LOUIS 20, MO. AND
TORONTO, ONT., CANADA

The overall view of the automatic testing area shows transformers moving along the electronically controlled test line. Test results for each transformer are recorded by equipment in the control room (left), eliminating the possibility of human error. The sequence of tests is as follows:

COPPER LOSS TEST—Not only checks the copper loss, but also checks circuit continuity.

RATIO TEST—Checks for correct transformation ratio to make certain that leads are connected properly. Ratio adjuster connections are checked during assembly operation.

IMPULSE TESTS—Made on the high voltage and low voltage windings to insure that the transformers will withstand lightning and switching surges.

INDUCED POTENTIAL TEST—Tests insulation between turns and between winding layers.

APPLIED POTENTIAL TEST—This test proves the quality of the insulation from windings to ground, and between high and low windings.

CORE LOSS AND EXCITING CURRENT TEST—Measures and records core loss and exciting current.

SOUND TEST—Determines and records audio sound level.

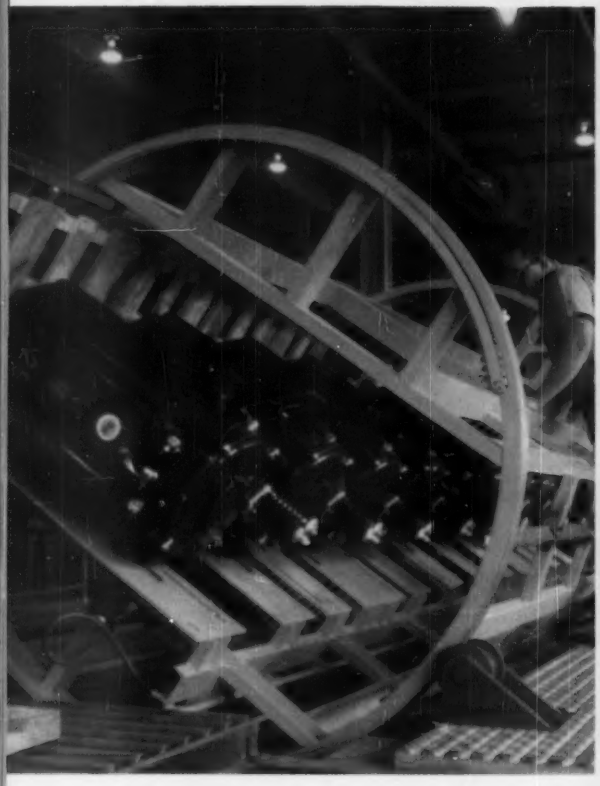
CIRCUIT BREAKER TEST (On CSP Transformers)—Checks low voltage circuit breaker and overload signal lights for proper operation under overload conditions.

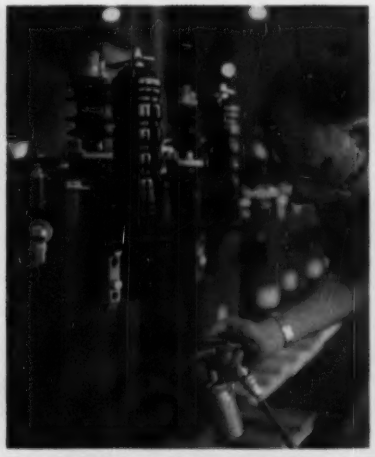
Transformers which fail any of the preceding tests are spray-spotted with color, which identifies the test, and are diverted to the reject line for examination to determine the reason for failure.

MOLONEY ELECTRIC

PLUS QUALITY CHECKS AND TESTS

An upside down leak test is performed to make certain that all gaskets provide perfectly oil-tight and air-tight seals. Transformers are also checked for scuffs and scratches in the paint. Touch-up paint is applied and then thoroughly baked to assure uniform quality of the protective finish.





No Moloney Distribution Transformer is shipped until it has written its own certificate of quality by successfully passing the rigorous series of tests to which it is subjected on the Automatic Testing Line. This is your assurance of receiving top quality—Moloney quality.

LITHO U. S. A.

MOLONEY ELECTRIC COMPANY

Manufacturers of
Transformers for Utilities, Industry and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

EDITORIALS

Industrial Modernization—Bonanza for Power Sales

Electric utilities are spending time and money to assure healthy growth of new industrial loads in their service areas. Such area development efforts, aimed at attracting new industries are bearing fruit in terms of revenue and are prudent investments indeed.

However, concentration on the attractive aspects of area development should not be permitted to overshadow the opportunities that exist for building load among existing industrial customers. Their plants may not be new but in that very fact lies opportunities for load development that are not being fully realized.

To compete economically with the automatic, labor-saving machinery that is the hallmark of today's new factories, these older plants must modernize their production equipment and methods. Most of them, for example, are in particular need of conveyor systems to speed the handling of materials and parts in production. These needs add up to more power requirements and improved power distribution facilities.

To utilities whose power sales forces have been kept alert through sustained development and training, this situation offers promising opportunities for substantial revenue gains. The enormous growth in industrial activity that has taken place makes this a situation tailor-made for alert power sales engineers. Adequate, well-trained manpower and hard selling tactics should produce outstanding results in increased industrial revenue and improved customer good will.

Water Heating: Simplify It to Sell It—II

We return once more to the matter of electric water heating and its problems. Previous editorials on this page have discussed the problems generally, and the need for equipment standardization in particular. Now we turn to the obstacles inherent in water heater service—the demand charges, controlled charging periods, and local codes—which must be modernized if we are to revitalize this essential load.

Rates play an extremely heavy role in the sales of any residential service. Manufacturers can reduce the number of models, simplify design, streamline their operations, cut production costs, and come up with a water heater that compares favorably with other types in first cost and performance. But if it costs too much to operate, or if customers do not receive first-class hot water service, acceptance will be slow at best.

Controlled charging boosts the installed cost of water heaters and in some cases may not give the best hot water service. This breeds misgivings in the minds of users and particularly in the minds of prospective buyers.

Obsolete or discriminatory codes can turn those misgivings into resistance that cripples sales. And when such obstacles are super-imposed on rates that offer questionable incentives to the customer it is no wonder electric water heaters are difficult to sell and remain in dealers' storerooms.

Electric utilities can no longer afford to tolerate such obstacles. Their effect is already evident in the loss of electric water heating business to competing types.

The time for action is now. Archaic and unfair restrictions must be wiped out and service practices geared to today's living needs. The aim must be to have electric water heating taken as much for granted by customer and utility alike as lighting or refrigeration. This is vital to our ultimate objective —the all-electric home.

Power Dam

With one year left before power goes on the line, project is 'right on schedule'

A hot, dusty summer—the kind that finds cement contractors sleeping easily at night—has seen construction going full tilt on the St. Lawrence Power Project. And the fast 'round-the-clock pace will quicken on the American side of the huge undertaking as some 6,500 construction workers hurry to pour concrete before the snow flies.

Powerhouse work on Barnhart Island is well past the halfway point, according to engineers of the New York State Power Authority, and "is right on schedule." More than 75% of required concrete has been poured. Power will go on the line in September, 1958.

The impact of the recent cement strike was felt, "but not seriously," the engineers say. Much of the cement for the 3,300 ft long gravity dam and powerhouse is delivered from the Canadian side by means of a pipeline. Canada's cement output was unaffected by the strike.

The power phase of the over-all project will produce 1,470 Mw of

'ROUND-THE-CLOCK CONSTRUCTION speeds concrete work on Barnhart Island's combined dam and powerhouse, which will produce 1,470 Mw of firm capacity

DOWNSTREAM FACE of the power dam, seen from the United States end, is rising quickly

Pace Quickens on the St. Lawrence

firm capacity from 32 generating units, 16 in the American plant and the other half in the Canadian. Capability for all the generating units will be 1,880 Mw.

Shipment of the 57-Mw turbines and generators began this year. They are being received on 45 day intervals for each set.

Key Personnel in at Start

About five of the key men who will supervise St. Lawrence Power Dam operations have been on the job since work started in 1954. They are working with representatives of Allis-Chalmers Manufacturing Co and Baldwin-Lima-Hamilton Co, each of which is supplying eight turbines for the U. S. side, and General Electric Co, which is supplying the 16 generators.

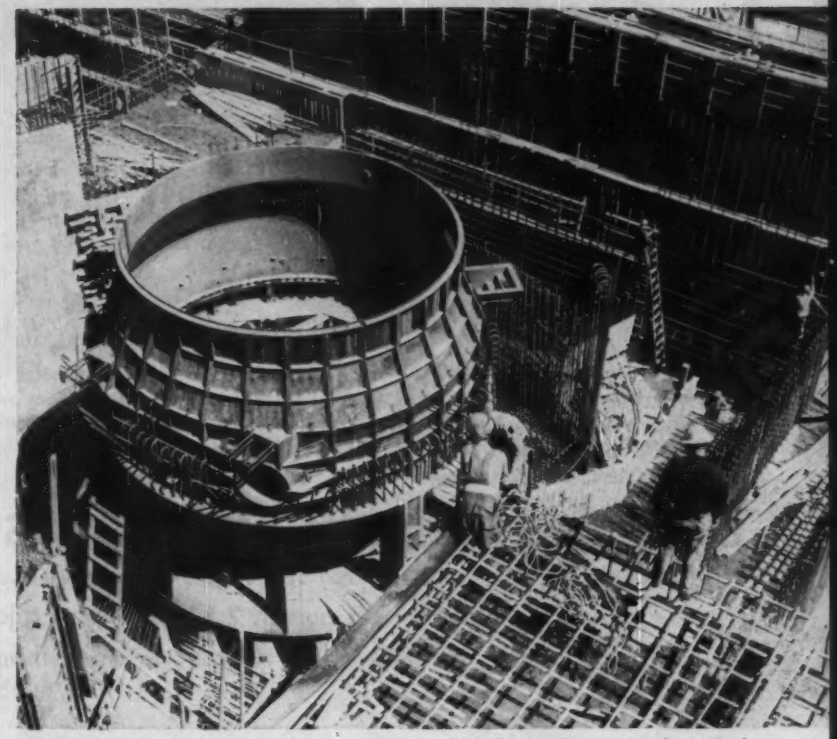
These 16 units will be divided into groups of four. Each group will be connected to a bank of three single-phase transformers. Station power for each two generators will be obtained from unit substations located at the equipment gallery connected to the generator bus.

The generators will have self-contained water cooling systems. Turbines will be vertical shaft with fixed-blade propeller runners. Rated capacity of each turbine will be 71,000 hp at 81-ft head and a maximum output of 85,000 hp at 87 ft. Governors will be oil pressure, relay-valve actuator type of units.

Power and the Seaway

The St. Lawrence Power Project is a separate undertaking from the Seaway Project, which federal governments of Canada and the U. S. are underwriting. But joint use of the river requires that both projects be coordinated in planning and operation.

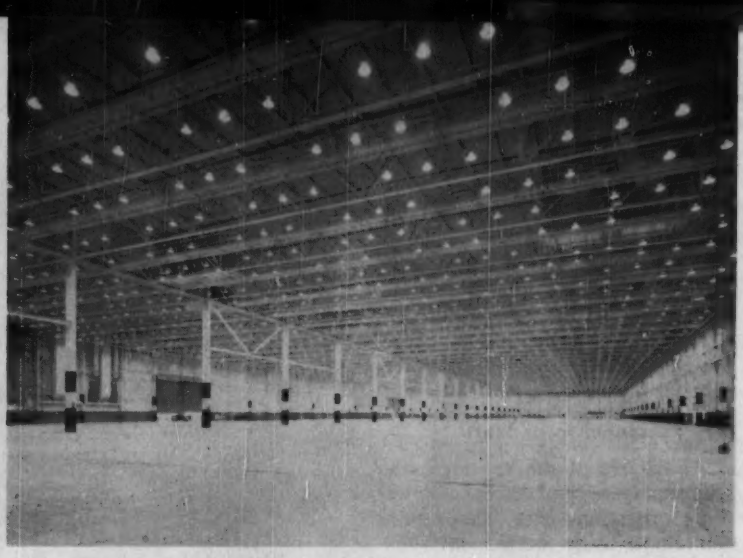
Total cost of the power project is estimated at $600 million. The New York authority has raised $335 million for its share by sale of revenue bonds. This covers construction costs for the U. S. portion of the nearly completed Iroquois Dam, Long Sault Dam, Massena Intake, relocation of highways and railroads, dikes, and channel improvements involving some 63-million cubic yards of excavation.



SPEED RING for one of the 16 U. S. units topped by the pit liner is in place. Each turbine generator will produce 57 Mw and have 71,000-hp rated capacity

SWITCHYARD AREA contains rows of oil circuit breakers. Power will be generated at 138 kv, and stepped up to 115 and 230 kv for transmission

MERCURY VAPOR UNITS light two new buildings of Douglas Aircraft Co in Long Beach, Calif. 5,767 of them are installed in high-bays, reportedly producing glareless, comfortable illumination over long 1,144 ft of working area



Douglas Installs 22 Acres of Light

California plane maker puts in 2,500-kw lighting job indicative of industrial lighting consciousness. Output is more than 118 million lumens

What may be the biggest indoor mercury lighting installation in the United States was purchased recently by Douglas Aircraft Co. Billed as "22 acres of cheerfulness," the job is installed in two new buildings at the company's Long Beach, Calif., plant. It has been pegged by one engineer as "characteristic of the bigness and goodness of industrial lighting in America."

The two buildings, known as the "structures building," and the "final assembly building," each provide an interior view exceeding 1,000 ft in length. The first measures 1,144 x 480 ft; the second 1,140 x 360 ft. Together they take 5,767 400-w color-corrected mercury vapor units. Mounting height in the first building is 43 ft; in the second, 53 ft.

Glare Reported Eliminated

Despite the tremendous area illuminated and the high number of lamps, glare is said to be practically eliminated. A man inside the building reportedly is able to see down the more than 1,000 ft with considerable comfort. Secret of this comfort is the relatively good distribution of ft-candles on both horizontal and vertical surfaces. Initial ft-candle values average: horizontal—90; vertical—50; and 45-deg.—73. After about 1,500 hrs of burning these values diminish, but the relative values do not change much. They stand, respectively, at: 76, 40 and 60 ft-candles.

Reflectance factors also enter the picture. Walls and ceiling, painted a light cream color, have an R. F. of 70%. The concrete floor has 30%.

The job, which is connected to Southern California Edison Co's lines, is a big power consumer. With 2,500 kw of connected load, the lights burn for 19 hrs a day, six days a week. Kwhr consumption is estimated at almost 1½ million a year.

Lumen output is also way up. Total is put at 118,224,000, perhaps the greatest volume of man-made light in any single installation in the world. Annual lumen-hrs are estimated at 700 billion!

The 5,767 units are the neck-ventilated, drip-shielded, 7⅛-in. dia. type made by Holophane Co, N. Y.

Distribution voltage is 277 v. Servicing in the structures building is accomplished from a movable crane, and in the final assembly building from catwalks. Switching is broken down into four quadrants, with four main disconnects at each corner.

OUTSIDE VIEW of buildings gives some idea of their tremendous size. Difference in roof heights accounts for different mounting heights of lamps

Growing Federal Power Seen 'Live Issue' . . .

. . . in 1958 and 1960 elections by E. A. Yates, who launches attack on tax exemptions and low interest charges

Federal power promises to become a "very live issue" in the 1958 and 1960 elections because of a "concerted drive" by persons who are eager to "extend facilities for manufacture and distribution of power at taxpayers' expense."

This prediction was made by Eugene A. Yates, board chairman of the Southern Co, in a recent talk before the Nantucket (Mass.) Rotary Club.

Hitting hard at the "ever-increasing tempo" with which government power has expanded since the early 1930's, he pointed out that today about 20% of U. S. consumers—private and industrial—receive electricity from government plants. During this time, the government spent over $10 billion for these power facilities, he said. "This money comes from federal taxes, compulsorily exacted from the wages and earnings of the American citizens."

Yates said the "benefactors of this public power bonanza enjoy a windfall at the expense of other taxpayers by reason of freedom from taxation and low interest charges."

Large private industrial firms receive 13% of the power sold by TVA and thereby save "about $10 million a year," he charged. In the Northwest, he added, where 40% of the sales of the Columbia River power system is devoted to heavy industry, taxpayers are "providing a power system costing $640 million for these firms' use."

By way of contrast, he pointed out that the total taxes paid out last year by private electric companies amounted to 23.4 cents of each dollar of their gross revenue. Total federal taxes alone, he said, amounted to $1.74 billion.

Power Politics

To illustrate how "politics enters into government power," Yates said that four current measures—Hells Canyon, Niagara, TVA revenue bond financing, and atomic energy plants—if approved, "would involve an expenditure of over $2 billion with the discriminatory benefits flowing largely to preferred customers. The federal tax subsidy alone would be over $60 million a year."

ATOMIC PROGRESS

Nuclear Notes

Atomic Energy Commission has given U. S. architect-engineering firms 23 days in which to come up with proposals for the engineering design of the 40,000-kw natural uranium gas-cooled project authorized in the last days of this session of Congress. All proposals must be submitted by Sept. 23.

First operator's license for a nuclear power plant has been issued by AEC to General Electric Co for its 5,000-kw boiling water reactor at Pleasonton, Calif. The experimental unit, which is connected to Pacific Gas & Electric Co's system, will be used to develop data for the proposed 180,000-kw unit of the Commonwealth Edison Co group in Chicago.

Reactor core assembly will take place in a small plant to be built soon near Montville, Conn., by Olin Mathieson Chemical Corp. Plans call for completion in the spring of 1958.

A new snag for construction of Power Reactor Development Co's atomic plant is in the offing. The city council of Windsor, Ontario, plans to ask the Canadian government to intervene with the U. S., claiming the plant may be hazardous. The council acted upon details supplied by George Burt, United Auto Workers' Canadian director.

About 80,000 kwhr were produced by Southern California Edison Co's Sodium Reactor Experiment plant during July. First power runs were in the 2,000-3,000 thermal kw range. Later, about one-third of its 20,000-kw heat capacity was achieved.

Foreign developments: Italy has five major projects underway which include plans for a 150-Mw plant between Rome and Naples a 135-Mw BWR to be supplied by Westinghouse; a 134-Mw project backed by Montecatini and Fiat; a 125-Mw Calder Hall type reactor which the British will supply; and a 125-Mw PWR plan on which Vitro Corp will serve as consultants.

Wales will likely have one or more nuclear stations, according to Central Electricity Authority. It has selected a seashore site with cooling water supply equal to demands of a 500-Mw station and mentioned the suitability of a second site.

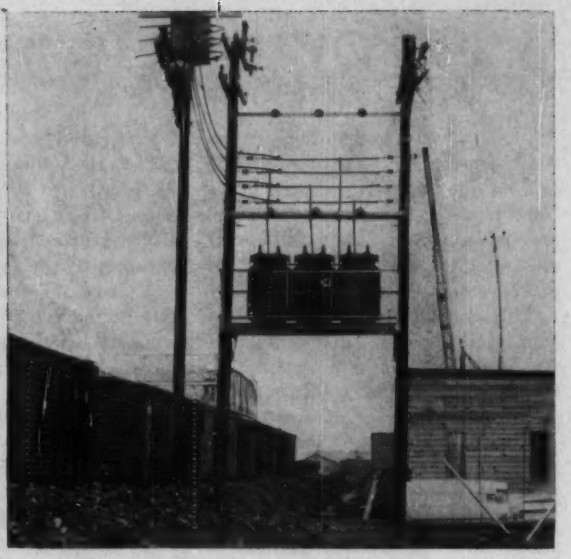
Britain has agreed to supply the initial charge of fuel elements for Norway's Halden reactor project, which is scheduled for operation early in 1958. The reactor will produce process steam suitable for wood pulp mills and other industrial uses.

East Germany's first atomic reactor will go into operation soon near Dresden. The 2,000-kw water-cooled reactor is run on enriched uranium supplied by Russia.

Insurance Erratum

Commonwealth Edison Co will pay $250,000 for private insurance coverage on its 630,000 thermal kw plant which is under construction near Chicago. Electrical World attributed the amount of the insurance premium to Consolidated Edison Co of New York, Inc.

With these power needs met . . .



Diversified loads are target as . . .

Reappraisal of REA Act Sharpens

GOP and Administration haven't declared war on co-ops but questions on 2% interest rate, big G&T projects, and service to non-farm users come under closer scrutiny

Rumblings heard about co-ops during the last session of Congress —and there were some—did not signal a war on co-ops by Republicans and the Administration.

Yet a situation is developing. It is a situation with a number of facets, any one of which can develop into a major controversy.

At present the political approach is cautious. No legislator wants to burn his fingers, neither do Administration officials. But questions are being raised, both in the Administration and in Congress.

Since most U. S. farms have electricity, must co-ops continue to expand beyond the needs purely of the farmer? Should co-ops install large generating facilities to meet, in addition to rural demands, those of industrial and commercial customers? Should co-ops take on urban loads as cities expand? Do co-ops have complete area responsibility to supply electricity? Should REA continue to lend money to co-ops at 2% interest when the money costs the government 4%?

Many of these questions can be summed up in one: Is the Rural Electrification Act out of date? Certainly, officials point out, today's conditions are not those of 20 years ago.

When rural electrification got underway seriously in 1936, 10% of the nation's farms had central station service. Today 95% are linked up. Yet rural electrification loan applications are increasing and will continue to increase.

It is not so much the fact of the increase that concerns officials as the question of what percentage of this increase is for farms and what percentage for other use.

For instance, today roughly 50% of the co-ops' income dollar comes from farm load. The other 50% comes from non-farm residential, commercial, and industrial customers.

Congressmen and government officials point out that today's electric co-op is a mature operation. The initial task of bringing electricity to farms is completed.

Now electric co-ops are in the process of beefing up their distribution systems to bring more power to the farmer as he finds increased uses for power, and improving service reliability.

In growing up co-ops have come against some economic realities of the power business and are seeking to diversify for greater efficiency and economy. To do this they must go outside the farm.

Is This REA's Purpose?

Again comes the question: should they do this with 2% REA money when the 2% interest ceiling was introduced for the benefit of farmers; not commerce, industry, or non-farm residents?

These are facts that lie behind recent happenings in Washington —the debate over whether or not the Administration has curtailed lending authority of REA Administrator David Hamil; the speeches in Congress about REA; and the explosive $42-million loan application from Hoosier Energy Cooperative, Inc, in Indiana.

Last May, nine Indiana electric co-ops formed their own generating

company, Hoosier Cooperative Energy, Inc, and applied to REA for a $42 million loan, the largest request in REA history.

The money, said Hoosier, would go to build a generating plant with three 66,000-kw units to meet co-op power needs over the next ten years.

Plant Will Move In

But this arrangement contemplates location within the co-op's territory of an aluminum reduction plant by Richards & Associates of Georgia. If Hoosier obtains its loan, the aluminum company will finance a fourth 66,000-kw unit.

The co-ops, now buying power from Indianapolis Power & Light Co and other utilities, say they would have first call on the power from this generating station with the remainder supplying the aluminum firm.

Utilities supplying the co-ops' needs say the nine never used more than 41,000 kw. In 1956 they consumed 186 million kwhr. Now they plan to install their own capacity of 198,000 kw (ultimately 264,000 kw) to produce potentially 1,200 million kwhr a year.

The implication is that the co-ops want to expand to take on an industrial customer in face of the fact that local electric companies are willing and able to meet demands of existing and potential customers.

Implications Are Clear

Implications of this are as clear as for suburban electrification. If one co-op can attract industry with low-cost power bait derived from low-cost federal money, then others must be given the same privilege.

Hamil still has the Hoosier application under consideration, but he has been maneuvered into a difficult position. Whatever he does is going to be wrong.

Impinging on the whole picture is the fundamental question of whether the electric co-op is public power or whether it is private enterprise.

Most Republicans in Congress and Administration officials regard the co-op as private enterprise. They resent the fact, however, that many co-ops are fast becoming, they claim, captives of federal power supporters in Washington.

This thinking was behind Senate debate recently when Frank A. Barrett (R-Wyo.) delivered one of the most detailed, objective pictures of REA yet heard in Congress.

Barrett was joined in his views by such GOP Senators as Carl Curtis (Neb.), Gordon Allott (Colo.), Karl Mundt (S.D.), Barry Goldwater (Ariz.), Sherman Cooper (Ky.), Edward Thye (Minn.), Roman Hruska (Neb.), and Frank Carlson (Kans.).

They Resent Label

These men, many of whom vote for federal power projects, have the same resentment: That they should be branded as anti-co-op because they have voted against some federal project that may have nothing to do with their states' co-ops.

Barrett, Goldwater, Curtis, and Allott pin the blame for this directly on present leadership of National Rural Electric Cooperative Association, the co-ops' Washington trade and lobbying group.

This association, these Senators charge, contributed heavily to financing activities of National Hells Canyon Association, which spearheaded the long fight for a federal Hells Canyon Dam and has consistently supported all moves for federal power advancement.

These men are staunch supporters of co-ops. When they vote against a Niagara or a Hells Canyon, they resent being branded anti-co-op.

Mundt probably summed it up as well as anyone when he expressed hope that Senate debate would button down for all time the fact that co-ops are not public power and those "who try to delude the farmer owners and operators of REA by endeavoring to make them feel that they are part of a big public ownership socialized segment of our economy are either ill informed or ill intentioned."

Administration's Aim

Above all, officials emphasize the Administration does not want to lay down a set of REA demands on Congress.

President Eisenhower in his budget message suggested that Congress look into interest rates for all lending agencies, not only REA. During the session legislation was introduced to increase REA rates in line with the government's cost of money. There was no action on these bills.

At the same time, Barrett's resolution pegged present rates at 2%. Mundt endorsed this.

Appraisal Must Come

There was little disposition in Congress to tamper with the subject and there will be less in 1958 —an election year. But a number of congressmen believe a realistic appraisal must come sooner or later. At a recent news conference the President again pointed to the spread that now exists between REA loans at 2% and 4% cost to government.

Administration officials, however, want Congress to solve the problem and they plan continued prodding until somebody acts. If Congress can't work it out, Administration officials feel there may be some other approach.

If co-ops are to have area responsibility for power supply and if an increasing share of their loan funds is going to go for non-farm electrification, then, say officials, perhaps co-ops should prepare to put up some of their own money or borrow from conventional sources to finance non-farm portions of their expansion.

Obviously this will not be possible for all co-ops. But many, officials say, are sound financially and could afford it.

Problem Is Explosive

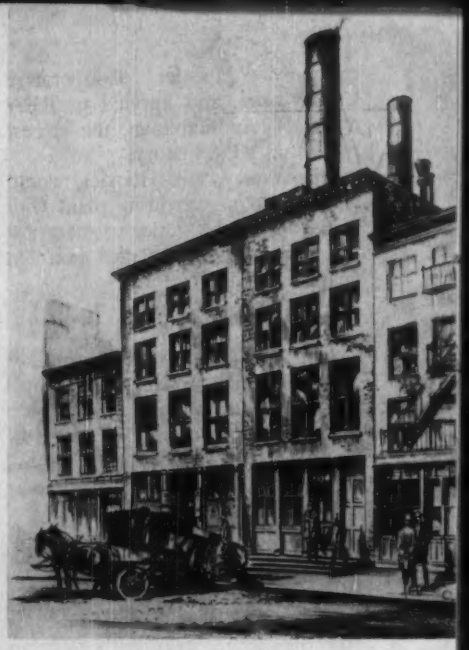
The problems involved are complex and politically explosive. But the Administration believes that if Congress and farmers understand them, there will be a willingness to work them out. What they fear is that federal power proponents in and out of Congress will never allow these problems to be discussed dispassionately.

When Agriculture Secretary Benson confirmed recently that REA loan applications over $500,000 are being reviewed by Kenneth L. Scott, director of Agricultural Credit Services, federal power supporters charged that Hamil's authority had been curtailed.

Hamil replied he is still in full authority for approving loans. What the review procedure does signify is that the Administration is watching this situation closely.

First Central Station's Pearl Street 'Miracle' Passes Its 75th Year

- Thomas Edison 'half expected that some new phenomena would interfere' in station's start
- Two-wire underground system served 59 customers in 1882. Today, Con Ed supplies eight million



On a September evening 75 years ago, 100 lights suddenly flashed on in New York City's Drexel building. Simultaneously, lights glittered in the windows of the Park Bank and in the newspaper offices of the Times and the Herald.

It was a spectacular opening night for Edison Electric Lighting System, heralding the world's first attempt to light a large district by incandescent lamps.

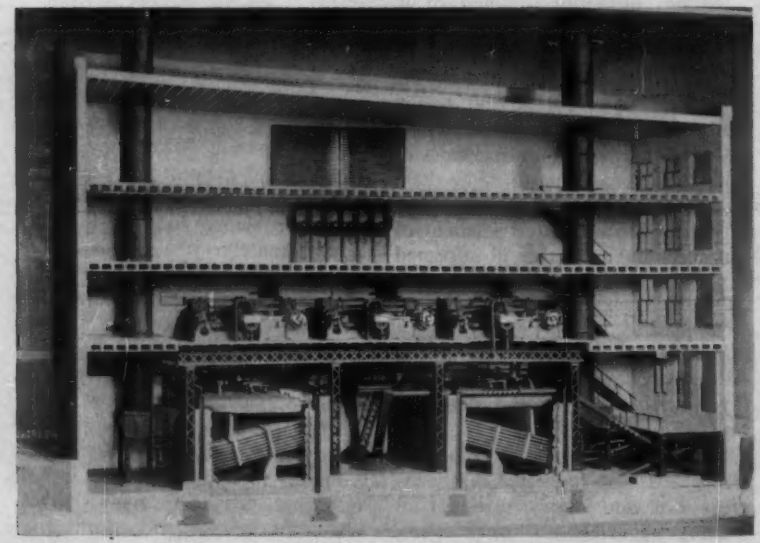
Meanwhile, in the Pearl Street Station where this 'miracle' originated, the countenance of Thomas Alva Edison showed that he was greatly pleased.

"I have accomplished all that I promised," he told a reporter from Electrical World. "It was not without some fear that I started this machinery this evening. I half expected that some new phenomena would interfere with the working of the light. But it has been entirely successful."

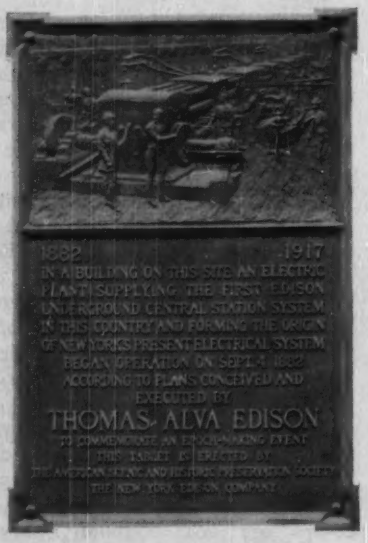
That was September 4, 1882, when the little station at 257 Pearl Street began operating on one engine capable of illuminating 800 lights. Before long, the company had 59 customers in an area which covered about 1 square mile. The station's six engines supplied 120 v of dc current through the two-wire underground system.

Today, Consolidated Edison Co, of New York, Inc, EEIC's successor, has eight million customers in a 600 square mile area who are served by 138 kv. The sprawling underground system is composed of 319 million lb of copper and 1 million lb of aluminum.

The drama of that September evening cannot be fully recaptured. But today, on the 75th anniversary, Edison's achievement is remembered as congratulatory telegrams flow into Con Ed's offices and utilities across the nation honor Edison for his famous accomplishment.



SIX DYNAMOS, each with capacity of 1,200 16-candlepower 110-v lamps were housed on second floor. Steam at 120-lb pressure was supplied by four boilers



LOFT BUILDING that now occupies station site bears this plaque

'Cut and Cover' Vs. Tunnels

Federal Power Commission told the New York State Power Authority last week that it will issue a partial license for the Niagara Falls power project in advance of a public hearing.

The license, said FPC, will be issued as soon as engineering reports are received from its field officers. However, the license will not approve the proposed reservoir and conduits leading to the site until after the hearing. City of Niagara Falls objects to the authority's plan to "cut and cover" the conduits. Local officials want a deeper underground tunnel through the city than the proposed 65 ft depth.

Robert Moses, chairman of the authority, termed the partial license "worthless." He estimated that additional tunneling would increase the project's cost by $1 million and that the public hearings would cause unnecessary delay in financing and construction.

Finnell's Formula Works

Ralph Finnell's retirement last month marked what Kansas Gas & Electric Co believes is a unique safety record. A veteran of 38 years service, Finnell has been superintendent of the 94.3-Mw Ripley Plant since it went on the line in 1938. In those 19 years of 'round-the-clock operation no man under his supervision suffered a lost time accident.

Finnell's formula: "No job is so rushed that we can't take time to plan it properly. Our men are trained not to take chances."

Bill Pattern for the Future?

A Manhattan customer of the Trade Bank & Trust Co always pays his bills by check. Last month, though, he lacked an envelope. Undaunted, he made out the check to Consolidated Edison Co of New York, Inc, addressed and stamped it on the other side, and dropped it into the corner mail box. The utility received it promptly.

Noted the bank: "This proves that a check as a means of exchange has achieved a new position of recognition and honor. Could it be a pattern for the future?"

Keeping Up With Jones

One of the two much-disputed TVA board vacancies has finally been filled. President Eisenhower last week made an interim appointment of Arnold Jones, whom he nominated to the post on June 28. Jones, former deputy director of the Budget Bureau, was named to a nine-year term to succeed Harry Curtis, who retired.

TVA Democrats had blocked a vote in the Senate Public Works Committee on Jones, reportedly to force an interim appointment. This gives them a chance to see Jones in operation before they take up the nomination next year.

Another interim appointment is expected any day to bring the board up to full strength. The second vacancy was caused by the recent death of Raymond Paty, the remaining Truman appointee.

A leading contender is Frank Welsh, dean of the School of Agriculture, University of Kentucky.

Another name mentioned has been that of Carl A. Jones, publisher of a Johnsonville, Tenn., newspaper and owner of the Johnsonville radio station.

John Kirtley is another possibility. He is a vice president with Texas Gas Transmission Corp.

Two interim appointments would give TVA a functioning directorate again, since Chairman Herbert Vogel had been left without a quorum to run the agency.

Congressional sources report Eisenhower plans a second interim appointment to take the pressure off Arnold Jones. Otherwise, if Jones' decisions showed agreement with Vogel over the next few months, the committee would look upon Jones with suspicion.

Block Stops Conductor Jumps

Neales Pickett is a line supervisor who knew there was a way to keep conductor from jumping out of stringing blocks. Too often the Tulsa crews of Public Service Co of Oklahoma lost time replacing conductor, which often was damaged in the process. And the risk of a 'hot' contact was always present.

In his puttering, Pickett designed what he calls a "four-way stringing block." It has the conventional grooved pulley on which the conductor rides as it's pulled in. Three additional rollers—one at the top and one at each side—keep the conductor closely contained. Pickett has applied for a patent and has already sold some 100 blocks, the PSC employee magazine reports.

Chain Reaction

Sacramento Municipal Utility District recently created the post of assistant general superintendent. Herb Hunt, grade 1 electrical engineer, won the job on an examination basis. Then the chain reaction began.

Hunt's job was filled by transferring Max Limerick from operating. Limerick was replaced by Don Haight, promoted from assistant estimating supervisor. Bill Reece was upped from principal engineering estimator to fill Haight's spot. As the promotions and transfers traveled down the organization chart, nine other men had a change in status.

The end result was SMUD's hiring of a new auto messenger, Robert Troughton.

What Makes a

Psychological testing study spots qualities and characteristics of successful managers. Data help in making objective promotions

ROBB M. WINSBOROUGH, Vice President,
JOHN J. FLAHERTY, Psychologist,
Middle West Service Co, Chicago, Ill.

Experience, judgment, and long personal acquaintance are usually the things relied upon in selecting people for managerial responsibilities in an electric utility. There is no satisfactory substitute for experience and judgment. But there are things which can reinforce the exercise of judgment and improve successful choice percentages.

Information accumulated by psychological testing is one useful tool available to the public utility executive to assist him in successful selection of managerial employees. Test results give him objective standards which he can consider, along with all the other information he has, when he forms a judgment and makes a decision on promotion, transfer, or employment of a managerial employee.

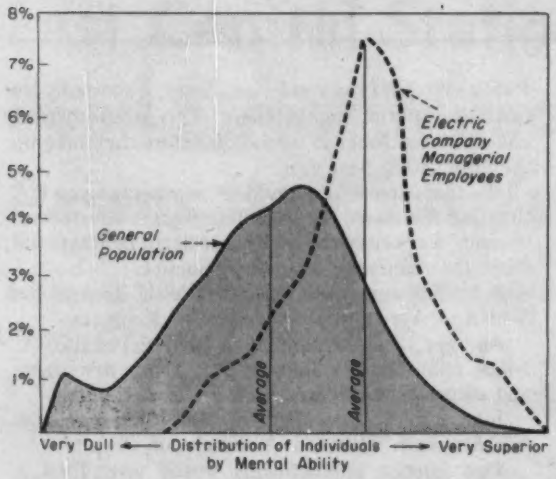


FIG 1: ABOVE AVERAGE mental ability is requisite for best managers. Only 12% are below population's average

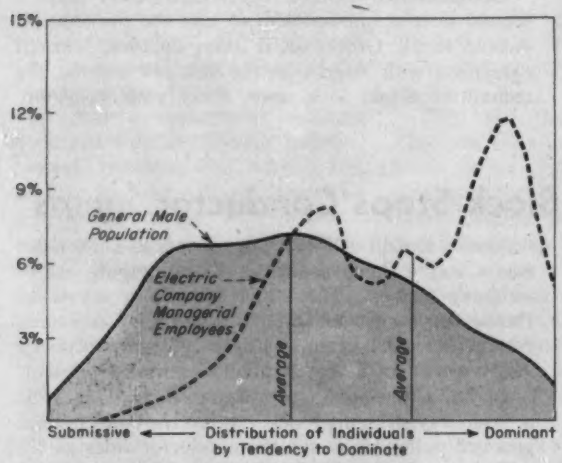


FIG 2: URGE FOR LEADERSHIP is a desirable characteristic. Just ¼ fall under dominance average of male population

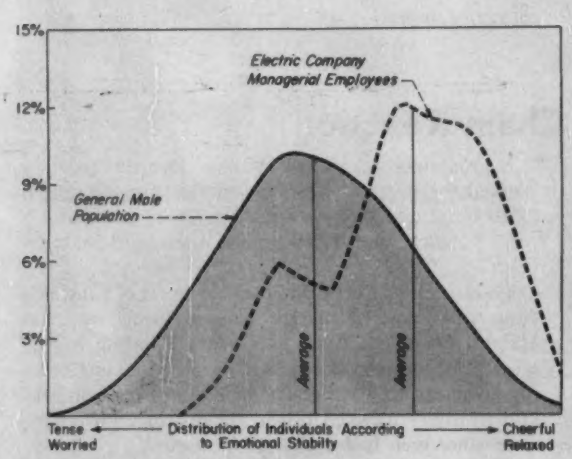


FIG 3: CALMNESS UNDER PRESSURE is trait of most good managers. Their emotional stability is well above U. S. males

Tests Help Find Right Man for Promotion

The charts show the value of such tests in helping executives to select proper people for managerial responsibilities. The charts reveal that some specific qualities and characteristics are found in successful managerial employees, as a group, which are not found to an equal extent in the general population, as a group, nor among less successful managers as a group.

The charts are derived from tests on 73 successful managerial employees of a transmission line company serving middle-sized and small cities. General office employees were excluded to avoid distortions which might come from high concentration of technically trained people in general office departments. Foremen of construction and line crews were also excluded.

The group of jobs included in this study are district managers, district engineers or operating superintendents, generating plant operating chiefs, division and district accounting supervisors, district and division sales managers, division and area managers. The total group comprises the field managerial personnel, exclusive of foremen. A separate group of 55 successful service representatives is also shown.

The significant conclusions which emerge are these:

Good Managers Rank High in Mental Ability

As a group, successful managers possess substantially more mental ability than the average of the general population (Fig. 1). The difference is significant. Only about 12% of the managerial employees in this sample fell below the average of the general population in mental ability. This indicates that few job applicants, and few employees, whose mental ability is less than the average of the general population will be able to work up into the managerial group. The conclusion is almost inescapable that better than average mental

Good Manager?

ability is a primary requirement for a good manager.

The temperament characteristic called "leadership" or "dominance" is possessed in a much higher degree by electric company managerial employees, as a group, than by the general male population at large (Fig. 2). The difference between the averages of the two groups is significant. Less than one-fourth of the managerial employees fall below the average of the male population in dominance. This seems to indicate that the urge for leadership is a necessary requirement, or at least a highly desirable characteristic.

Calmness in Emergencies a 'Must'

As a group, successful managers tend to be emotionally more stable than the average of the general male population (Fig. 3). This means they can remain reasonably calm under pressure, and act calmly in emergencies. Less than one-fourth of this group of successful managerial employees fell below the average of the general male population in emotional stability. This seems to indicate that emotional stability is almost a prerequisite for a successful manager.

Fig. 4 contrasts the distribution of service representatives with managerial employees on a mental ability scale. It shows that the two groups differ substantially, as groups. Less than one-fifth of the managers fall below the average of the service representatives in mental ability. On the other hand, more than 10% of the service representatives possess mental ability equal to or greater than the managerial average. This means the group of service representatives has a number of individuals who possess the mental ability to make successful managers, if they possess other requisite qualifications. The relationship between these groups indicates the possibility of an upward mobility of certain representatives into the managerial group.

As a group, the better performing managerial employees are considerably more inclined to activity than the poorer performing managerial employees (Fig. 5). Individuals ranking high in the vector, "Activity," are quick-thinking, quick-acting, energetic people. They are "on the go" a good part of the time.

As a group, better performing managerial employees decide and act more quickly than the poorer performing managerial employees (Fig. 6). The average of the better performing employees is somewhat higher than the average of the poorer performers.

'Norm' Can Supplement Promotion Methods

In any particular company actual test results would be somewhat different. The average or "norm" for a company can be established from test data on its own employees. Once established, these norms serve as a helpful guide. They can assist the executive in the exercise of judgment based upon his own experience and his knowledge of the people and company. Selection of people for promotion can often be more objective by use of such data. Percentage of successful choices for promotion to managerial positions can be increased by use of such test results to supplement present promotion methods.

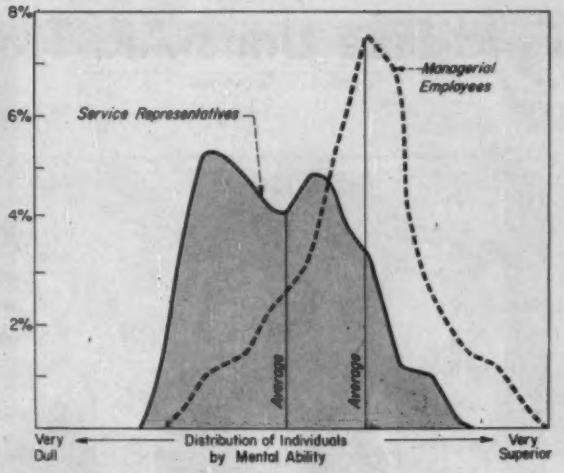


FIG 4: POTENTIAL MANAGERS, whose mental ability exceeds manager average, are found in top representatives

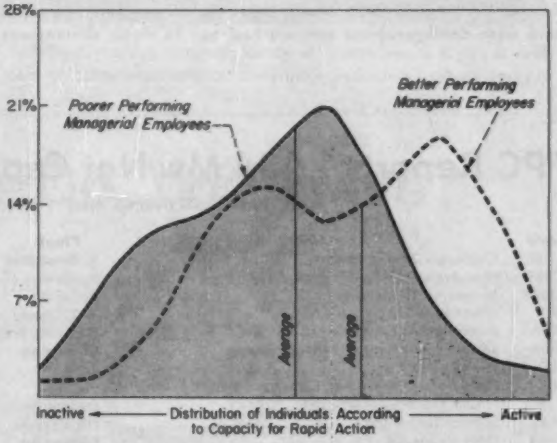


FIG 5: QUICK-ACTING, quick-thinking, energetic characteristics are significantly higher for better performing managers

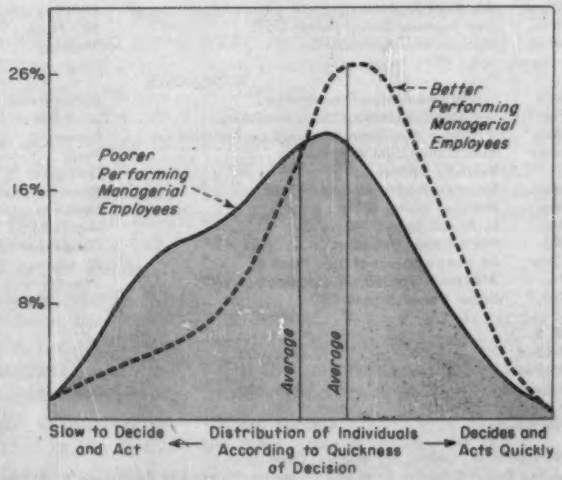
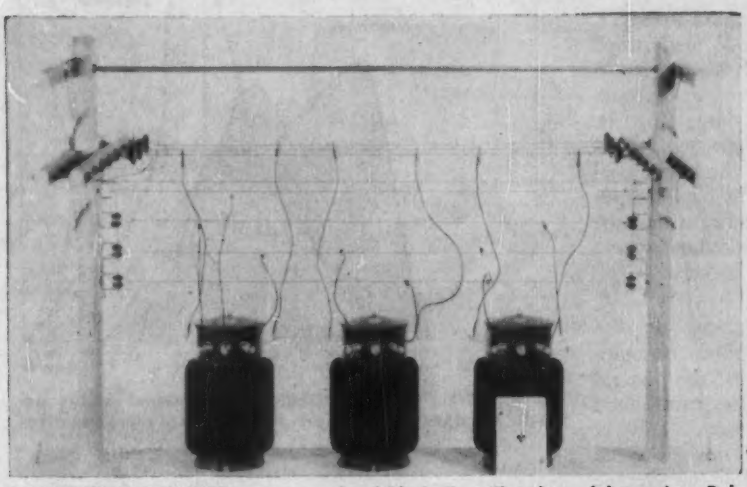


FIG 6: DECISION-MAKING is faster for the successful managerial group than for poorer performing managerial men

Card-Size Units Aid Training of Linemen



CONNECTION METHODS are grasped quickly in Tom Thumb model practice. Pole and wire configurations are worked out in three dimensions on popular kits

ROBERT VAN SLEEN, Director of Utilities, Gastonia Water & Light Dept, Gastonia, N. C.

Miniature transformers and pole assemblies have simplified instruction of linemen for Gastonia (N. C.) Water & Light Dept. Use of the working models, which look and act like their full-scale counterparts, permits linemen to assimilate connection methods more rapidly and, thus, perform their work with less confusion, fewer delays, and greater safety.

Simulates Working Voltages

The miniature transformers were built by the utility. They are 6½ in. high and resemble full-scale units. Inside each case is a 240—24½-v transformer. This primary voltage was selected because 3-phase 240-v service is available in most meter testing shops and warehouses. Also, by adding a zero to this voltage as well as the secondary voltages, linemen can recognize voltages they work with daily.

Winding leads run to the primary and secondary bushings, which are different sizes. These leads can be exposed by uncovering the transformer. Secondary leads can be connected to parallel or series the windings, and primary winding can be connected for additive or subtractive polarity. Windings are not accessible.

To further simulate actual transformers, an internal connection diagram was added to the nameplate.

Fuses Protect Men, Materials

These models can be connected up by linemen and voltages measured to verify the accuracy of their work. In the event of a mistake miniature fuses will blow to protect the equipment and personnel.

To simplify interconnecting of several units a scale-model kit was built. This includes a transformer platform, two poles, crossarms, bell insulators, secondary racks, and necessary hardware. Crossarms and poles are drilled, so the kit can be assembled to conform to almost all standard practices. "Hot-line clamps", operated by thumb pressure, connect the transformer leads to the busses.

FPC Reports 1,634 Mw Net Capacity Gain

PLANT ADDITIONS DURING JUNE

State	Utility	Plant	Fuel	Capacity
Calif.	California Electric Power Co.	S. Bernadino	S	60,000
Calif.	Pasadena Municipal Light & Power Dept.	Broadway	S	40,000
Idaho	Bureau of Reclamation	Palisades	H	28,500
Ill.	Commonwealth Edison Co.	Will County	S	275,000
Minn.	Blooming Prairie Municipal Utilities	Blooming Prairie	IC	1,400
Minn.	Owatonna Municipal Public Utilities	Owatonna	S	6,000
N.C.	Duke Power Co.	Allen	S	165,000
N.J.	Deepwater Operating Co. (controlled by Atlantic City Electric)	Deepwater	S	23,000
N.M.	El Paso Electric Co.	Rio Grande	S	44,000
Ohio	Ohio Edison Co.	Edgewater	S	100,000
Ohio	St. Marys Municipal Light Plant	St. Marys	S	6,000
Ore.	U.S. Army Engineers	Dallas Dam	H	13,500
Pa.	Pennsylvania Electric Co.	Seward	S	125,000
Pa.	Weatherly Borough Electric Dept.	Weatherly	IC	1,000
Tenn.	Tennessee Valley Authority	Gallatin	S	225,000
Wash.	U.S. Army Engineers	Chief Joseph	H	64,000
Wisc.	Lake Superior District Power Co.	Bay Front	S	25,000
Wisc.	Madison Gas & Electric Co.	Madison	S	44,000
	RETIREMENTS			
Ariz.	Navopache Electric Cooperative	Springerville	IC	408
Fla.	Florida Keys Electric Cooperative Assn.	Tavernier	IC	2,900
Iowa	Ft. Dodge, Des Moines & Southern Railroad Co.	Fraser	S	22,500
Iowa	Iowa Electric Light & Power Co.	Perry	IC	480
Ky.	Kentucky Utilities Co.	Lexington	S	6,500
Minn.	Blooming Prairie Municipal Utilities	Blooming Prairie	IC	72
Mo.	Shelbina Water & Light Plant	Shelbina	IC	500
Mo.	St. Joseph Light & Power Co.	Maryville #1	S	840
N.J.	Deepwater Operating Co.	Deepwater	S	12,500
Ohio	St. Marys Municipal Light Plant	St. Marys	S	750
Pa.	Weatherly Borough Electric Dept.	Weatherly	S	250
Tex.	Dallas Power & Light Co.	Dallas Plant	IC	6,000

U. S.	Hydro	Steam	IC	Total
Added	106,000	1,138,000	2,400	1,246,400
Retired	.....	43,340	10,360	53,700
Adjustments Plus	24,000	417,083	.....	441,083
Adjustments Minus	.....	.....	.....	.....
Net Change	130,000	1,511,743	−7,960	1,633,783

H—Hydro, S—Steam, IC—Internal Combustion

United States Capacity as of July 1—Hydro, 26,346,579 kw; Steam, 95,614,840 kw; IC, 2,466,994 wk; Total, 124,428,413 kw.

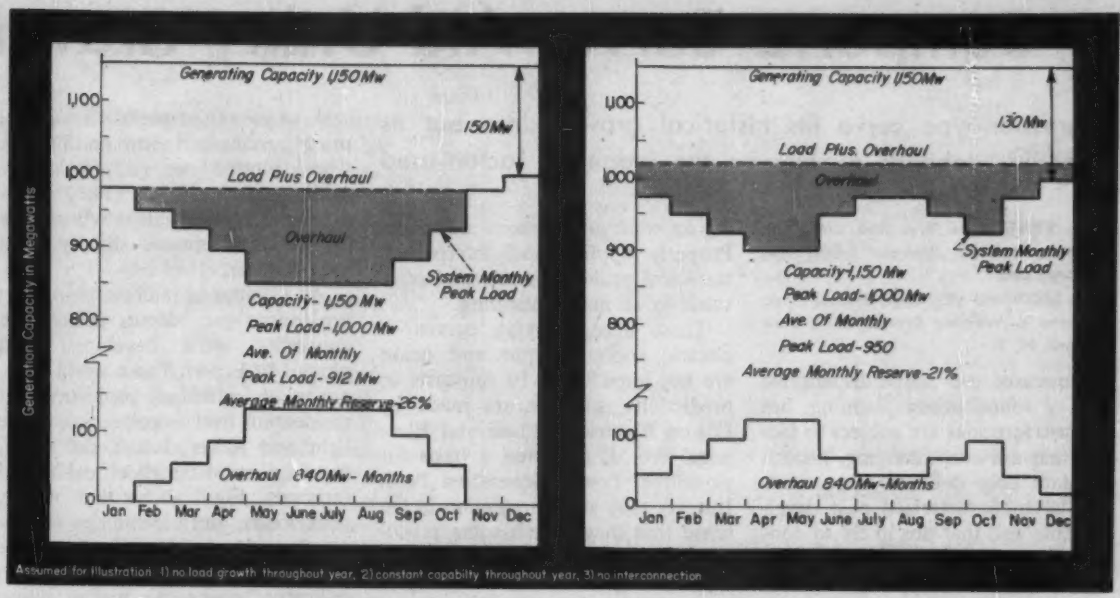


FIG 1—Loads of a few years ago with long summer valleys provided sufficient time for turbine generator overhauls

FIG 2—Growing summer loads of recent years make it difficult to schedule overhauls without reducing system reserve

How Much Reserve Do You Have?

Whether reserves are figured before or after overhaul provision becomes more important because of summer loads

K. M. SMITH, System Planning Engineer, Commonwealth Edison Co, Chicago, Ill.

How much reserve do you really have? Is it figured before or after allowance for overhaul and routine maintenance schedules?

It has been customary to talk about reserve generating capacity primarily in terms of percent difference between kilowatts total capacity and the system peak load. Changing system load curves plus the rapid increase in the number and size of units, and consequently the number of units that must be out for routine maintenance, influence the conventional line of thinking about reserves.

Comparison Shows Differences

The effect of these changes can be seen by an examination of the system conditions represented in Fig 1 and 2. Each system has the same generating capacity, 1,150 Mw, and the same peak load, 1,000 Mw. With the conventional way of figuring reserve, it would appear, therefore, that each system has a reserve of 150 Mw, or 15%.

Extra Margin Available

But, the load curve of Fig 1, with the long summer valley which prevailed on many systems only a few years ago, offers ample time for overhaul, 840 Mw-months that can be worked into the long valley of the load curve. At no time is the 150-Mw "peak" reserve decreased by the overhaul schedule. In fact, the overhaul schedule has been handled in a way that makes available an additional 20 Mw margin of capacity for 11 months of the year.

On the other hand, the conditions in Fig 2, showing summer and winter peaks, are becoming more and more common. In contrast with the situation described in Fig 1, the same 840 Mw-month overhaul schedule here reduces the system reserve of 150 Mw by 20 Mw over the entire year. This system, therefore, has actually only 130-Mw of reserve for forced outages. The summer load valley is not so deep and it does not last so long.

These illustrations point up the need for a change in the terms used in talking of system reserve. On one of these systems, the reserve capacity for forced outages is 150 Mw at the time of the peak, and averages nearly 170 Mw. On the other system, the contingency reserve is actually only 130 Mw, peak or average.

The system represented by Fig 1 has an average reserve of 26% to cover overhaul and forced outages. In the same terms, the other system, with summer and winter peaks, has only 21% average reserve.

Terms Need Restudy

It appears, from these examples, that some serious thought must be given to the terms used in speaking of reserves. Otherwise, the industry itself will not know what is meant by the figures it quotes on its own reserves. Nor will individual companies fully realize the true meaning of their own reserve figures.

Gompertz Curves Aid Utility Growth

Regression-type curve fits historical growth data but its reliability depends greatly on the judgment factor used

E. H. KRIEG, Vice Pres and Consulting Engr, Stone & Webster Engineering Corp, and
H. C. LEONARD JR., Engr, Electric Dept, Stone & Webster Service Corp, New York, N. Y.

Forecasts are an indispensable part of sound utility planning, but because forecasts are subject to factors that are ever changing, historical data help delineate the trends that have characterized past developments and that are likely to continue.

Of the several types of mathematically fitted regression curves, the Gompertz is particularly favored in examining long term utility trends because it accurately fits a large body of utility data. Its reliability has been demonstrated and it follows a pattern when projected which satisfies the classic patterns of growth so often seen in population and economic trends.

In this article the Gompertz curve is used to demonstrate that judgment is still the indispensable factor in all planning and that even the best of statistical devices may produce widely varying results, depending on what assumptions are made. Properly applied and interpreted, statistical projections prove of great value in all major planning.

These accompanying curves of electric energy output and peaks are not intended to be forecasts or predictions, such as are made by Edison Electric Institute and Electrical World, nor even a basis for an annual Power Generation Pool. Instead, they are a projection in the sense that they sketch some procedures useful in forecasting. In doing this, it is hoped to initiate an interest in statistical techniques for analyzing growth patterns so that one can better judge whether a forecast is likely to be too optimistic or too pessimistic.

The latest Electrical World forecasts for 1957-1970, published in the Sept. 2, 1957 issue, are shown by circles on Fig. 1. The forecasts apparently lie close to a straight line. But one may well ask why should these forecasts lie on a straight line. This presumes that utility growth trends have continuously enjoyed a uniform rate of growth which will continue. This is doubtful: The rates of growth of population and of most businesses follow an S curve when plotted on rectangular or arithmetic coordinates. They follow a logistic type of curve whose rate of growth decreases slightly from year to year.

As a matter of interest, Gompertz projections for output, peaks, and capability were developed and plotted in Fig 1. These are a composite of individual projections of residential use, commercial, large light and power, losses and other, just as done in the Electrical World forecasts. Fig 1 shows that output, peak loads, and capabilities lie approximately on a smooth curve projected through 1955-6 figures to indicate "where do we go from here." Mr. Sporn's prediction of 2 trillion kwhr in 1975 is a little below the 2.55 trillion indicated by the curve. The Electrical World forecast is much more conservative than if based on the rate of growth from 1946 to 1956, which, if extended, would result in a forecast of 3.5 trillion kwhr in 1975.

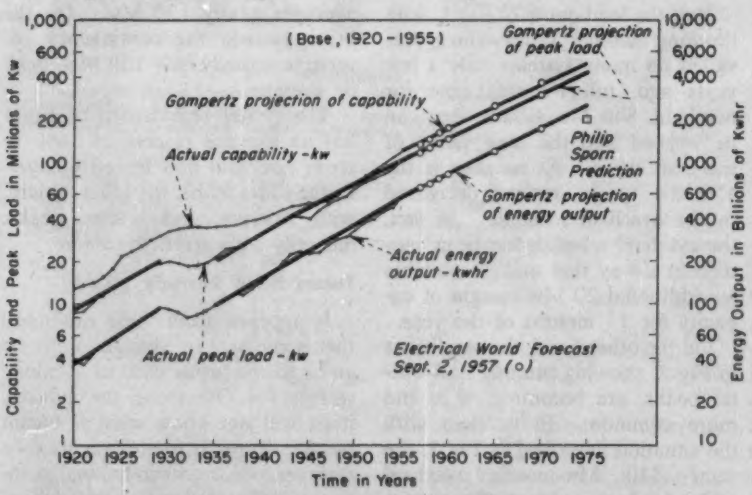
Depression Years Omitted

Whereas Fig 1 is based on 1920-1956 data, the inclusion of the years of most rapid growth from 1902 to 1920 on Fig 2 are needed to show clearly how the rate of growth has been decreasing since the first industry data available from 1902. These curves use the years 1902 and 1956 as end points and 1927 as the midpoint, the typical depression years having been eliminated. This was done by moving the trend curve of 1935-1955 six years to the left to 1929. This shows a slightly lower rate of increase causing the Electrical World forecasts to be slightly high. The Sporn estimate of 2 trillion kwhr in 1975 is now slightly above the 1.9 trillion kwhr projection.

Some statisticians believe that a Gompertz projection that uses an initial year and the current year as the actual midpoint gives a good result. But reason and intuition cause one to question whether the trend should pass above or below rather than through the actual figures for 1955-56.

To obtain a trend that appeals to

Fig 1—Gompertz Projection of Electric Utility Generation and Peaks



GOMPERTZ CURVES of electric utility industry capability and capacity based on projection through 1955-56 figures produce smooth curves on semi-log graph

Predictions

experience and judgment suggests applying the actual yearly figures to a Gompertz projection. This has been done in Fig 3. Using annual energy outputs from 1902 to date with three time periods—1903-18, 1919-40, and 1941-56—the forecast for 1960-1975 is quite pessimistic, yielding only 1.56 trillion kwhr in 1975.

The output curves of Fig. 1, 2 and 3 indicate how the growth-rate following a depression is appreciably greater than the main trend. Such changes in rate of increase follow the historical cyclic pattern characterizing population and business trends. But the output curve of Fig 3 could be severely criticized because it shows only 520 billion kwhr output for 1956. This output was actually 601 billion. That is why it is emphasized that this discussion is only for initiating interest in a subject whose possibilities have not been completely explored.

All these projections or trends are based on the same general mathematical formula and reasonably fit historical data. Yet each shows a different rate of growth. This may be readily understood when we realize that the pattern of industry development has been one of cyclic activity overlying the basic expanding trend. Since the last depression we have completed two major cycles, one ending in 1938 and the other in 1945-46.

Our normal growth years are decidedly more vigorous than the long-range trend, and we must, therefore, often make a definite distinction between long and short-term forecasting.

For example, a projection based on growth in the last decade would greatly exceed the predictions previously discussed. In this sense, perhaps Fig 1 & 2 should be regarded as "working papers".

The logarithmic plotting in these figures is necessary for studying this type of rapidly expanding growth, although logarithmic plotting so greatly foreshortens annual increases that the continuous vigorous yearly growth of each projection is almost completely masked.

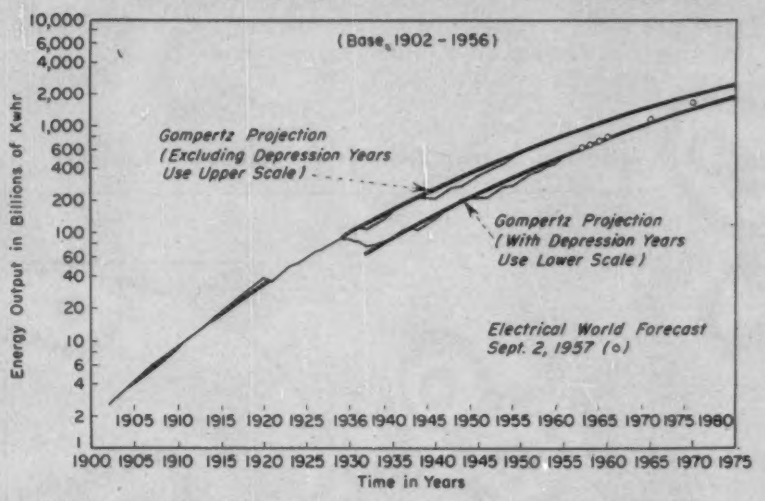
No industry expands indefinitely at a constant rate. Eventually, in even the most vigorous industries, a falling off in the rate of growth occurs. The projections in this article show a rate of growth which decreases slightly each year, yet despite this decreasing rate the actual amount of yearly growth in output and peak load increases for many years as in Fig 4.

This particular type of projection appears to reason and intuition, for it describes the type of utility growth we have known and now anticipate: **1.** The slow beginning in the industry's early years; **2.** Rapid expansion; **3.** Maturity or saturation.

Fig. 4 also belies the seeming pessimism of Fig 3 by showing that, when Fig 3 is projected further on the same mathematical curve, the electric utility industry is shown on the threshold of tremendous expansion, even with the slightly decreasing rate of growth. No one need bolster his optimism of industry growth by assuming too high a growth rate for the next several years.

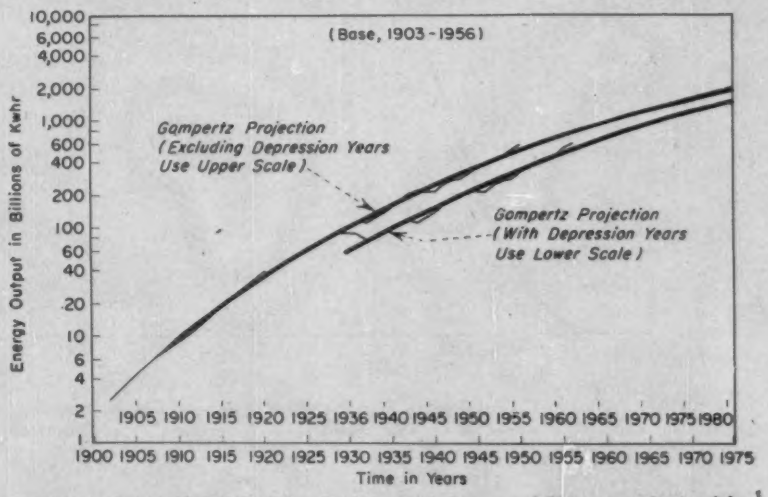
The most common method of forecasting growth is to fit historical data with a straight line on semi-logarithmic paper. This method anticipates future growth as occurring

Fig. 2—Gompertz Projection of Electric Utility Generation



BROADER TIME BASE (1902-1956) produces a long-term trend. Effect of depression years is removed by moving 1933-55 trend curves six years to left to 1929

Fig. 3—Gompertz Projection of Electric Utility Generation

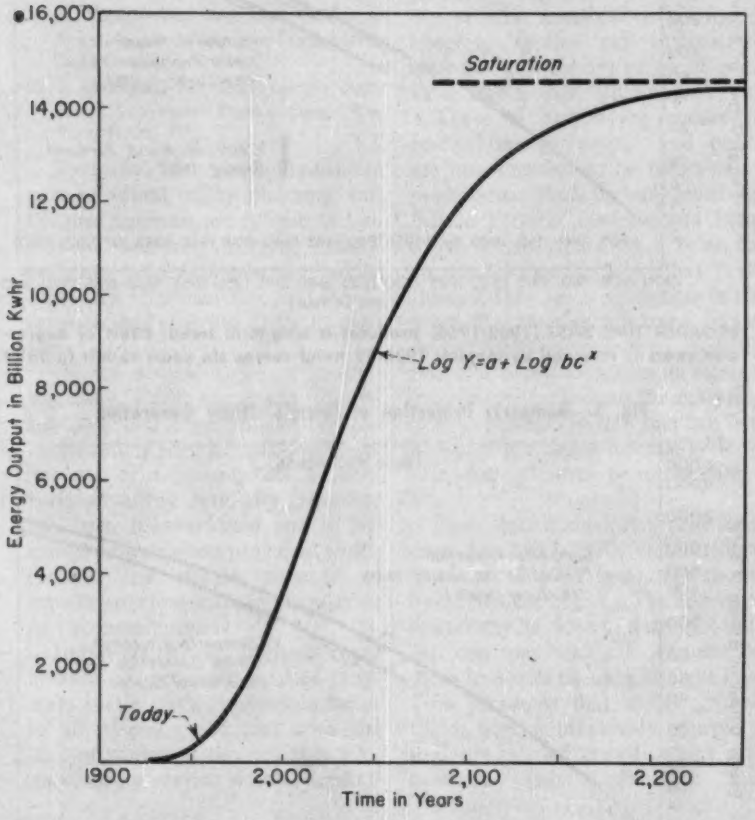


PESSIMISTIC PREDICTIONS of the future generation capabilities are obtained by basing the projection on three time intervals: 1903-18, 1919-40, and 1941-56

at a constant rate. But because the long-term trend of population growth is likely to decrease, ultimately several thousand kw of generation would be available per capita. This we cannot easily visualize. An exponential curve of the saturating type, such as the Gompertz, avoids this.

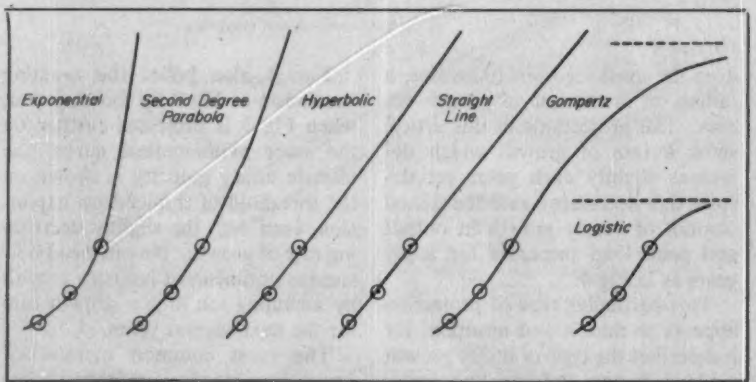
We are all interested in national trends, but our chief concern is usually with a local situation. The same techniques used in analyzing national trends are most pertinent when applied to individual companies. An exponential curve modified for decreasing rate of growth is often indicated, but a number of other curves are also used in short-range forecasting.

Fig. 4—Long Term Gompertz Projection of Electric Utility Generation



NO LONGER PESSIMISTIC, Fig 3 looks like this when drawn on Cartesian coordinates. An expanding future is shown despite yearly decrease in growth rate

Fig 5—Common Mathematical Projections Fitted to Identical Points



COMMON UTILITY time series can usually be described by one or more of mathematical curves shown above. The Gompertz and the logistic curves seem to satisfy best the classic growth concepts and one's experience and judgment

The straight line ($Y = a + b\,x$) is often used in data correlation in projecting growth in utility customers, and for numerous other analytical purposes. Its chief advantage is simplicity. This curve, however, seldom fits historical data on energy output, generation peaks, or other utility time trends and, because it does "compound the interest" annually, the rate of increase falls much too sharply.

Used for Short Term Trends

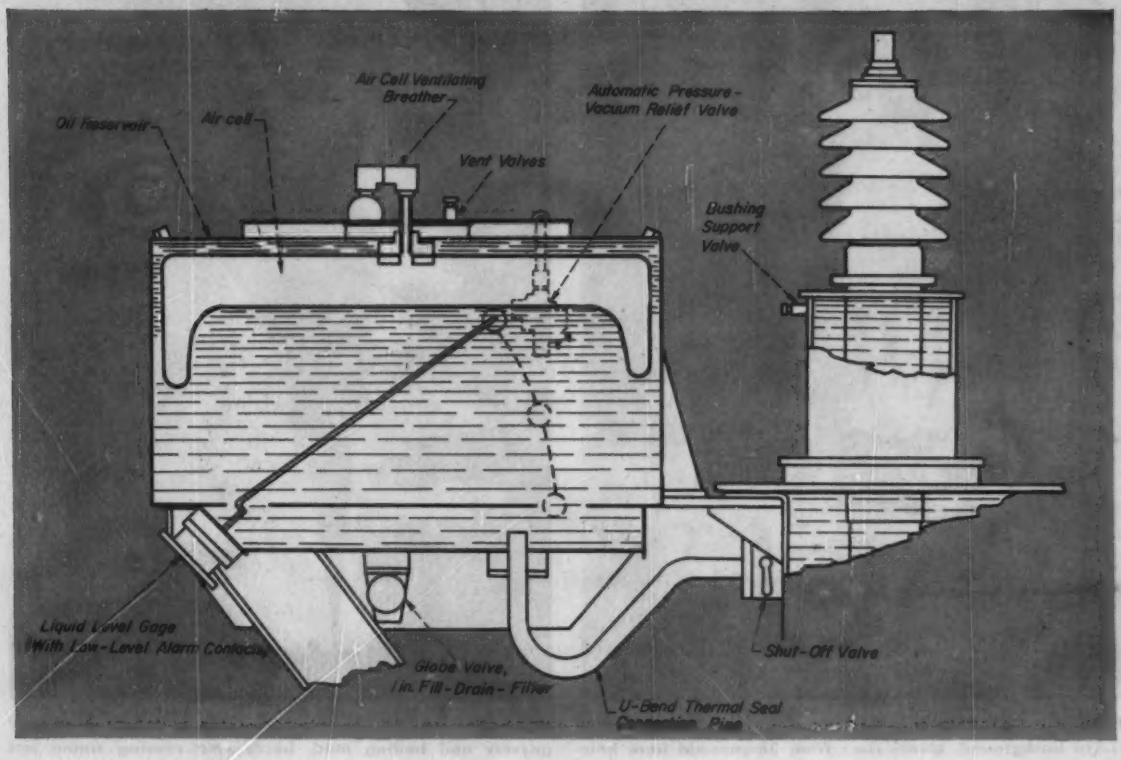
The exponential curve ($\log Y = a + b\,x$) which describes a straight line on semi-logarithmic paper is used extensively in projecting short-term generation trends and customer growth. On the debit side, the curve fits only constant-growth data.

The second degree parabola ($Y = a + bx + cx^2$) may be used with a much wider variety of data than either of the previous curves because data may range from a straight line to an extreme curve. A modification of this curve ($\log Y = a + bx + cx^2$) is useful in comparing data such as short-range generation trends.

The hyperbolic curve ($\log Y = a + b \log x$) has proved useful for many statistical purposes. but apparently has little application to the utility industry in its general form. A modification of this curve, the equilateral hyperbola ($xy = a$) is, however, almost indispensable in rate-schedule analysis.

The curves previously described may be fitted by the method of least squares, and at least one curve adequately describes the most common utility time series.

But two curves, the Gompertz and the logistic, seem to best satisfy classic growth concepts, one's experience and judgment. Both curves have been widely used in projecting growth patterns. From past experience, however, the logistic ($1/Y = a + bc^x$) has not proved reliable in the projection of basic utility statistics.



Atmoseal System Has New Features

Method of preserving oil in power transformer combines constant pressure and isolation of air and oil in the tank

W. J. DEGNAN, G. G. DOUCETTE JR, R. J. RINGLEE, General Electric Co, Pittsfield, Mass.

A new method of preserving oil in power transformers combines a constant-pressure feature with an impermeable, isolating diaphragm between the atmosphere and the oil in an expansion tank. Like the conservator, the new Atmoseal (GE trademark for constant-pressure oil preservation system) method needs negligible maintenance.

Constant-pressure oil preservation eliminates gas evolution and the hazard of intense corona and breakdown when pooled bubbles collect adjacent to regions of high dielectric stress. Such bubbles sometimes evolve profusely when a transformer, with a conventional pressure-regulated gas blanket cools quickly after cyclic loading.

Tests show that the Atmoseal system, operating at atmospheric pressure, doesn't permit gas dissolved in the oil to approach critical bubble evolution conditions for even the most severe load cycles.

During cycling with the Atmoseal system, no bubbles were evolved during rapid cooling of a forced-oil-cooled power transformer following extended periods at full load during which equilibrium conditions of gas in oil were established.

In the new system, there is a cell of inert synthetic rubber, strengthened by a synthetic fabric to act as the air seal. This cell is inside the oil expansion tank, separating oil and air. The inside of the cell is connected to the atmosphere by a breather pipe, and the space between the cell and expansion tank is filled with oil. The cell literally floats on the oil. As the oil flows into the expansion tank, the cell air space diminishes, and the cell floats at a higher level in the tank.

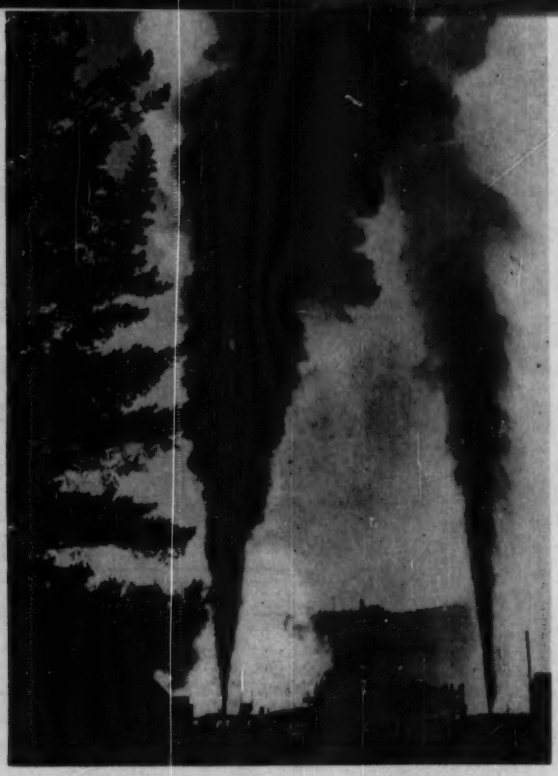
The cell's material is a synthetic Buna-N rubber reinforced with nylon fabric. The rubber is very similar to the nitrile rubber used for transformer gaskets.

Low height in the system's design minimizes interference with overhead leads, and the expansion tank's location provides small but positive oil pressure on the top of the transformer at all times. It incorporates the low maintenance features with the option of using a gas detector relay for fault protection.

The low expansion tanks have been designed to prevent loss of oil when the top porcelain of a bushing is fractured. The system is fail-safe. Should a leak develop in the cell, the system continues to function as a conservator, and a low-liquid warning is caused by the sunken cell. The Atmoseal cell thus combines the constant-pressure low-maintenance features of the conservator with the totally sealed feature of the insert gas sealed system.

Adapted from a paper delivered at summer general meeting of the American Institute of Electrical Engineers, June 28, 1957, Montreal, Canada.

FIRST, FIND STEAM. This T-12 rig is sinking a bore 2,000 ft. In background, steam rises from 38-year-old bore hole



NEXT, TAP IT. At the Wairakei site, a tourist Mecca of geysers and boiling mud, bores emit roaring steam jets

They're Drilling for Steam in New

NEW ZEALAND (Special to EW by McGraw-Hill World News) —New Zealand's mountainous North Island, lying in the southern temperate zone a thousand or so miles east of Australia, has become a new focal point for geothermal interest.

Peppered by volcanic peaks, which march in a wide strip northeast toward the Pacific, this island is to be the site of a new 250-Mw power plant driven by earth steam. Drilling rigs have been probing 2,000-ft depths steadily and already have won enough steam to feed a 69-Mw section of the proposed plant.

Special Problems Encountered

Some of the attendant problems involve steam quality, cooling water sources, heat flow within the earth, and—unlike exploring for oil—drilling into high temperatures and pressures.

The project is to be situated at Wairakei where the rate of natural heat flow through the earth is 20 to 100 times as great as is considered normal. Similar heat flows are found elsewhere, such as at Yellowstone, Wyo., but only in Iceland and Italy is the heat used commercially for power production. In Italy, natural-steam power plants generate about 300 Mw.

Earth Cracks Release Steam

It is generally believed that the earth steam source is caused by fractures in the earth's crust, resulting from surface stretching. These fissures allow high-temperature gases (principally water vapor at 1,800F) to escape from molten or semi-molten rock at "considerable" depths.

Drilling problems differ from those normally encountered in oil search. Chiefly the differences center about the greater temperatures and uncertainty as to geologic levels at which high pressure steam may be found. To help safeguard equipment and men at Wairakei, large reinforced concrete pits are built as drilling rig foundations. Surrounding ground is drilled and consolidated by forcing in cement grout. Blowout preventers at the well head enable drilling to proceed even when high-pressure is struck.

Chemical sampling shows that discharge in the most productive areas is 60-80% water. The rest is steam. Among minor constituents of the water and gases is lithium. (It was estimated last year that $2.8 million worth of this element would be contained in water used annually at Wairakei, but economics of extraction have not been worked out yet.)

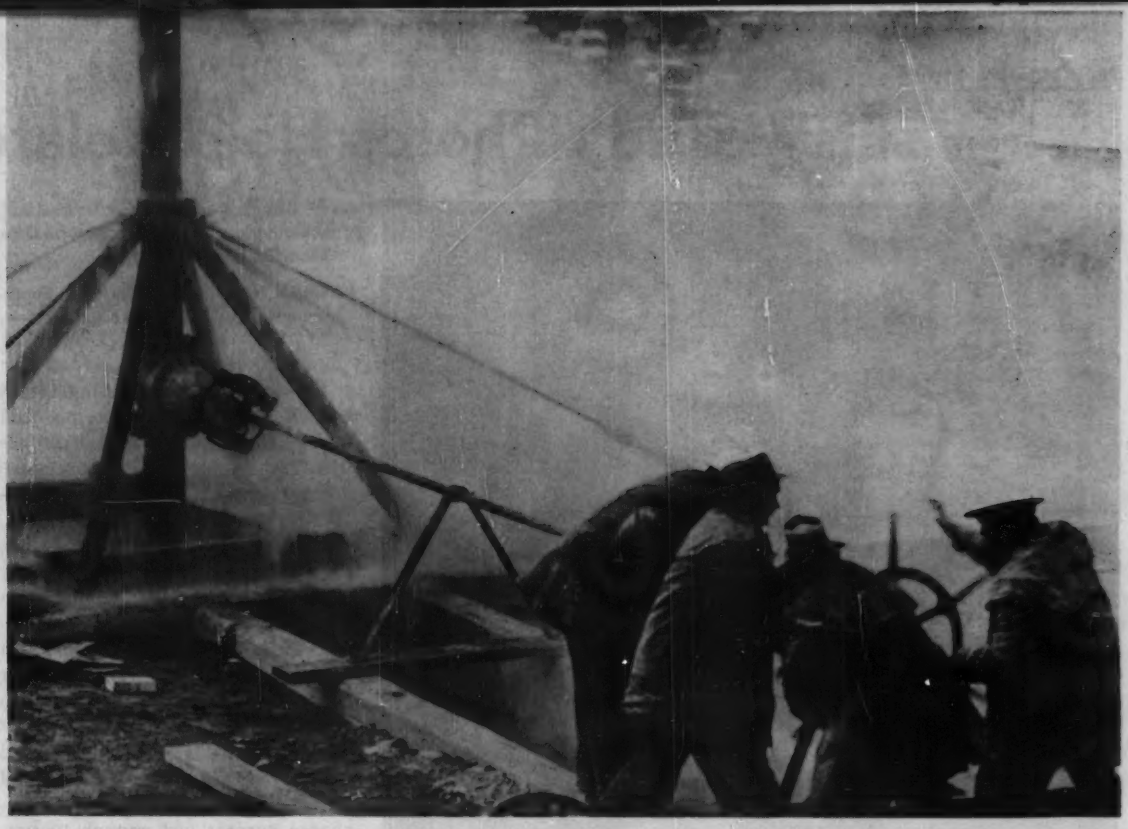
3-Stage Plan Created

As recommended by London engineers, the power plant is to be developed in three stages:

Stage 1, already under way, is to produce about 69 Mw late next year, using seven machines.

Stage 2, to provide 82.4 Mw with four units, may be completed possibly by next year also if present rate of steam-winning is kept up.

Stage 3, to provide a further 101.2 Mw, is justified, the engineers say. But this stage will be delayed until some operating experience has been obtained from



THEN CONTROL IT. Valve crew spins wheel (on a safety extension) to release pent-up pressure of steam and superheated water. The jet later became a 700-ft column which condensed and showered a nearby road with warm rain

Zealand to Power a 250-Mw Plant

Stage 1 relating to conversion of hot water from the bores into steam. Somewhat larger turbines are contemplated.

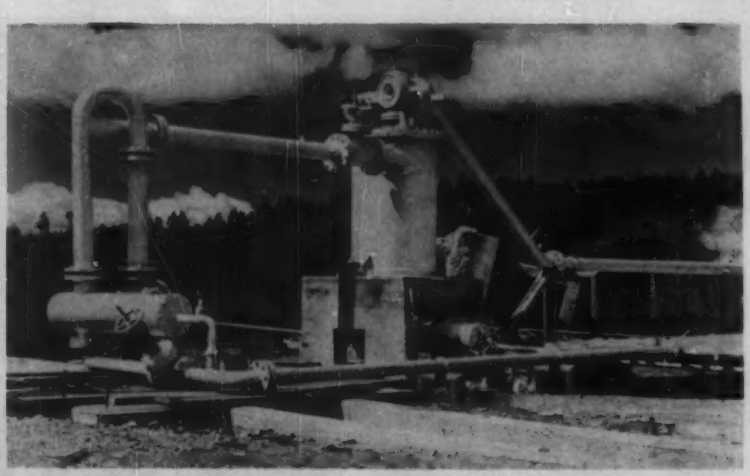
Capital costs of Stage 1 will be $21.7 million, of which $2.6 million would be for steam production and $19.1 million for construction and plant. Stage 2 is to cost about $18.4 million, and Stage 3, $20.5 million —a total capital outlay for 252.6 Mw of about $60 million.

Production costs for the 69 Mw of Stage 1, which would have a net capacity of 65.6 Mw, are expected to run about $2.41 million a year, or 5.2 mills per kwhr. For Stages 1 and 2 combined, with an installed capacity of 151.4 Mw and a net capacity of 143 Mw, estimated production costs are $4.5 million a year, or 4.5 mills per kwhr.

Steam Requires Separation

Because of the heavy water content of the steam, water separation is required before steam is piped to the turbines. Possibly some of the water at high pressure and temperature may be converted into steam at a lower pressure for driving a turbine.

After passing through the turbines, the steam is to be condensed by 250,000 gpm of cold water (for the full 250-Mw station) drawn from the Waikato River. Because of its large cooling water requirements, the station itself is near the river—not next to the steam bores. A line of five 20-in. pipes is being laid to carry the steam about 2 mi down to the power house on the riverbank.



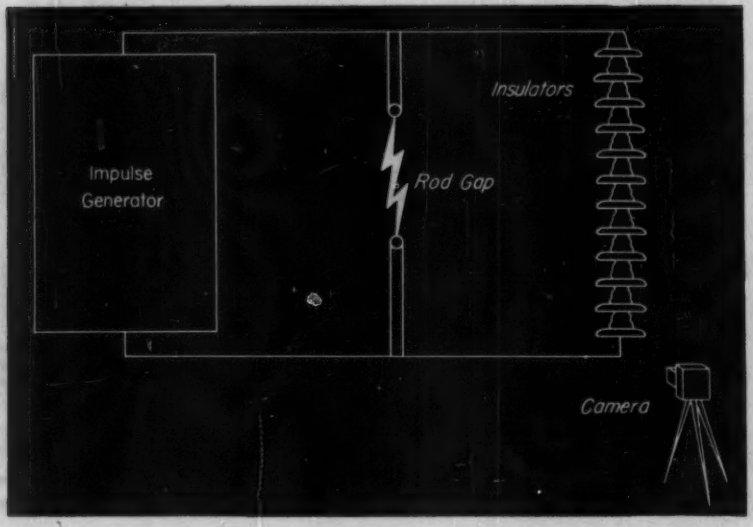
SPECIALLY DESIGNED SEPARATOR, using 180-deg U-bend, removes moisture from steam which otherwise could condense on turbine blades, causing serious damage

EHV Study Photos Help Relate

G. W. BURKE, Superintendent of Electrical Laboratories, Barberton Division, Ohio Brass Co, Barberton, Ohio

HERMAN HAGERDORN, Technical Representative, Eastman Kodak Co, Rochester, N. Y.

LABORTORY SETUP shows tower leg at left shunting insulators and charged by the 3-Mv impulse generator in the background. See schematic drawing below



Photography assisted Ohio Brass Co engineers in discovering that tower height was one of several factors responsible for an excessive number of lightning-produced outages on two new transmission lines. One line used slightly higher towers than previous designs.

Photos made by the engineers in their Barberton, Ohio, high-voltage laboratory, prompted the theory that tower height influenced flashover rate, and more photos helped to prove this hypothesis. Their photos of a laboratory arrangement showed plainly that a 22-ft tower leg could not ground a impulse generator discharge current fast enough to prevent flashovers on a 3-unit insulator string connected in parallel.

Voltage Builds Up

According to the traveling-wave theory, voltage rises rapidly at a tower top struck by lightning. This buildup continues until alleviated by a reflected wave of opposite polarity returning from the tower base. Even on the tallest tower, this return takes only a few tenths of a millionth of a second. The higher the tower, the more voltage builds up at its top before the first reflected wave returns.

The investigators' first step was the obvious one; they had to determine whether flashovers, like those troubling the two power lines, could be initiated in the limited time that lightning-produced voltages had to build up and remain on the tower, in accordance with the traveling-wave theory. Here photography played its role.

The engineers set up a 22-ft test section of a tower leg across the output terminals of an impulse generator. A 3-unit string of standard suspension insulators was connected in parallel with the tower leg. Then the impulse generator was charged to 2,500 kv, and a steep-wave discharge was fired into the circuit.

Tower Height to Flashover Rate

The insulators flashed before the tower leg could ground the discharge current.

Insulator String Studied

Photographic studies were made of insulator strings connected in parallel with a rod gap. With the impulse generator charged each time to the same voltage, the length of the gap was adjusted so that it barely prevented the discharge from flashing across the insulators, once the steep-front voltage was released by the impulse generator. Electrical stress, which immediately developed around the rod gap and the insulator string, caused the rod gap to flash over a fraction of a microsecond later.

A 4x5 Crown Graphic camera, loaded with Kodak Tri-X film pack, recorded the electrical stress on and around the insulators. This stress, evidenced by heavy corona streamers, occurred so rapidly that it was merely a flash of light to the human eye. But a clear image of the stress was photographed in the darkened area around the insulators. The camera's shutter was opened manually just before firing of the electrical impulse and closed about half a second later after the rod gap had flashed over.

The picture obtained reveals the corona streamers produced by a voltage about 97% of that required to produce total flashover. It shows that the bottom three and the top five insulators of the 12-unit string had already flashed over while the four remaining units were barely below flashover.

The study enabled the investigators to conclude that insulators in a string can all reach their flashover point almost instantaneously when struck by an extremely steep-front voltage wave.

Arc Hugs Porcelain

The photos showed that flashover could occur in the few tenths of a microsecond that elapse between the instant of contact of the lightning stroke with the tower top and return of the voltage-alleviating wave from the tower's base. They also showed that the flashover arc hugged both the upper and lower surfaces of each insulator in the string. The burns in the glaze of the laboratory units resembled closely those on units removed from the troubled power lines.

ELECTRICAL STRESS on 12 insulators was photographed just slightly short of flashover level. Surrounding corona streamers delineate electrostatic field about string

INCREASE in electrical stress is just enough to permit flashover. The arc of steep-front voltage impulse hugs upper and lower surfaces of insulators in suspended string

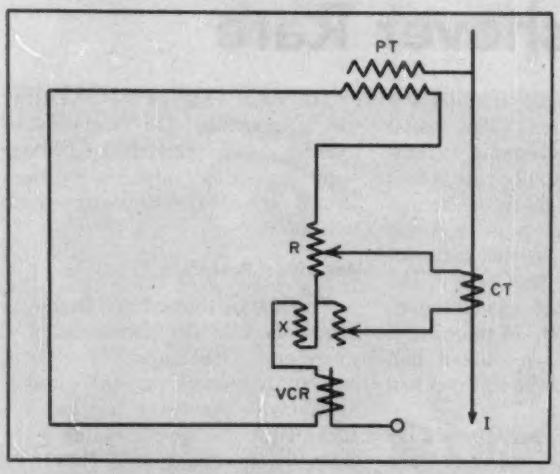


FIG 1—REVERSED-REACTANCE compensation control for parallel operation of two transformers requires only reversal of load current through the reactance element

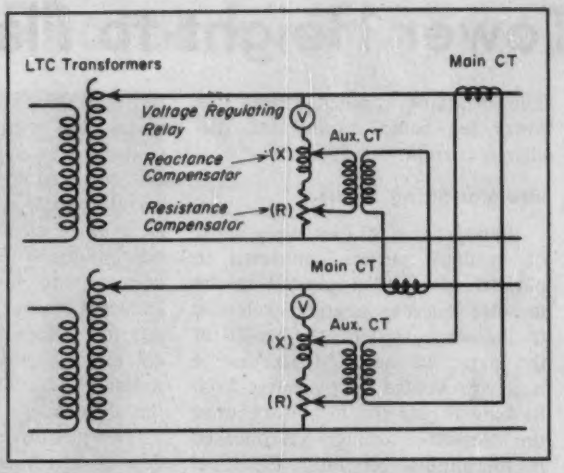


FIG 2—CROSS-CURRENT compensation for parallel operation requires control leads between transformers. It has been used for adjacent transformers in the same station

Control LTC's to Operate in Parallel

Raising allowable circulating current simplifies control of load tap changers on transformers, uses fewer circuits

W. C. SEALEY, Chief Engineer, Transformer and Regulator Depts, Allis-Chalmers Mfg Co, Milwaukee, Wisc.

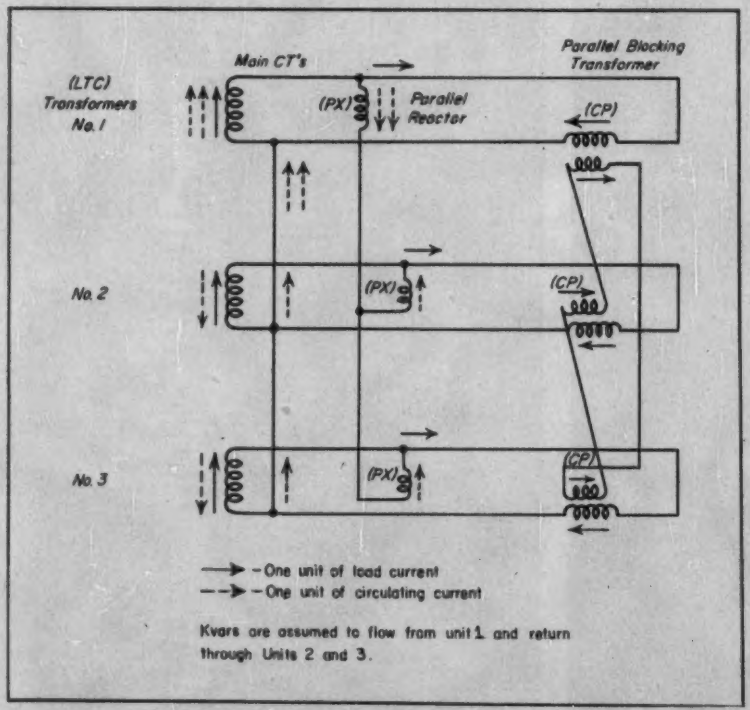


FIG 3—CURRENT-BALANCE portion of the current-balance method causes transformers which are higher or lower in voltage to move taps to average position

Control must be exercised over load-tap-changing transformers operating in parallel to keep their voltage ratios sufficiently close so as to limit circulating current. When tap-changer positions get too far apart, excessive circulating current causes transformers to overheat. Control schemes for operating LTC transformers in parallel may be simplified if slightly different voltage ratios, and thus a small circulating current, are permitted. The greater the permissible circulating current, the simpler the control circuit becomes and the fewer the interconnections required between transformers.

Requirements for parallel operation of LTC units are the same as those for any two transformers in parallel: Both should have the same voltage rating and no-load transformation ratio. The units should have the same percentage impedance based on their respective kva ratings, including the impedance of primary and secondary lines between points of paralleling. The resistance-reactance ratios should be the same.

If LTC transformers are too far

apart, the cost of control interconnections becomes prohibitive. But, in most of these cases, a considerable difference in voltage ratio may be permitted, and a simple method of holding ratios together may be used. Several methods have been devised, including:

1. Manual control.
2. Reversed reactance compensation.
3. Cross-current compensation.
4. Current balance.
5. Electrical interlocking.
6. Mechanical ties.

Generally, the simpler scheme is chosen for economy. But because of standardization, it may be desirable to choose a method which is the simplest for all usual operating conditions on the system. This may be the case even though the "standard" scheme is more complicated than necessary in some cases.

Tap Changers Move Apart

When transformers are controlled manually, the operator merely keeps the position indicators on the same taps. But two paralleled LTC transformers, with individual automatic voltage control relays, do not stay on similar taps, even though they are put in service in that way. Their rates of response differ; and after several operations the tap changers may be several positions apart. If line-drop compensation is used, particularly reactance compensation, a runaway effect of one unit applying full boost while the other applies full buck may be produced.

When two LTC transformers are paralleled, using reversed-reactance compensation control, it is necessary only to reverse the direction of load current through the reactance element. This is shown in Fig. 1. In this arrangement, when the first transformer completes its tap change first, circulating current flows between the units causing a voltage drop in the reactor in the compensator circuit. This tends to cause the mechanism to move in the opposite direction.

On the second transformer, circulating current causes the mechanism to run until the voltage nears the desired value. Depending on the value of reversed reactance used, the mechanisms move until they are either on the same step or sufficiently close to it to limit circulating

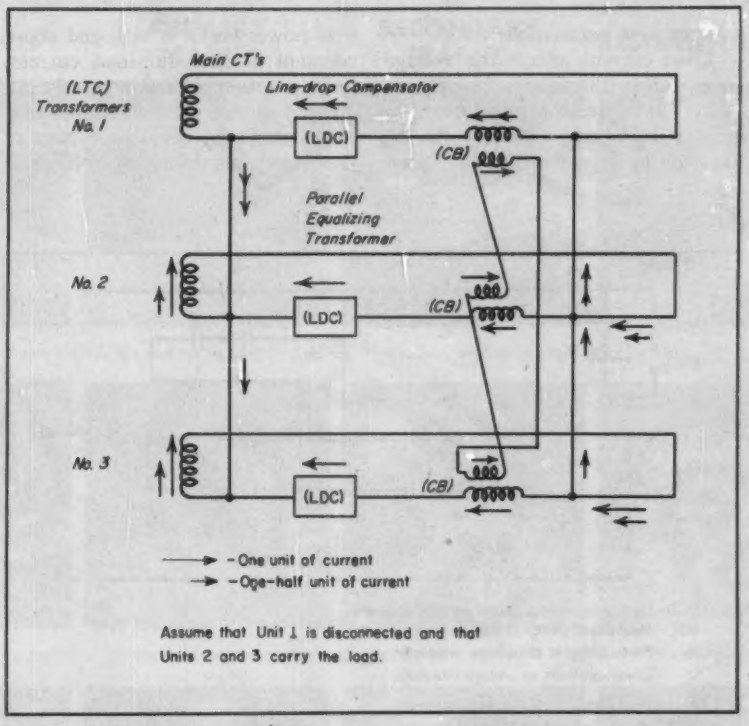


FIG 4—LOAD-CURRENT LINE-DROP portion of current-balance method takes the total line current and divides it equally among all transformers in parallel

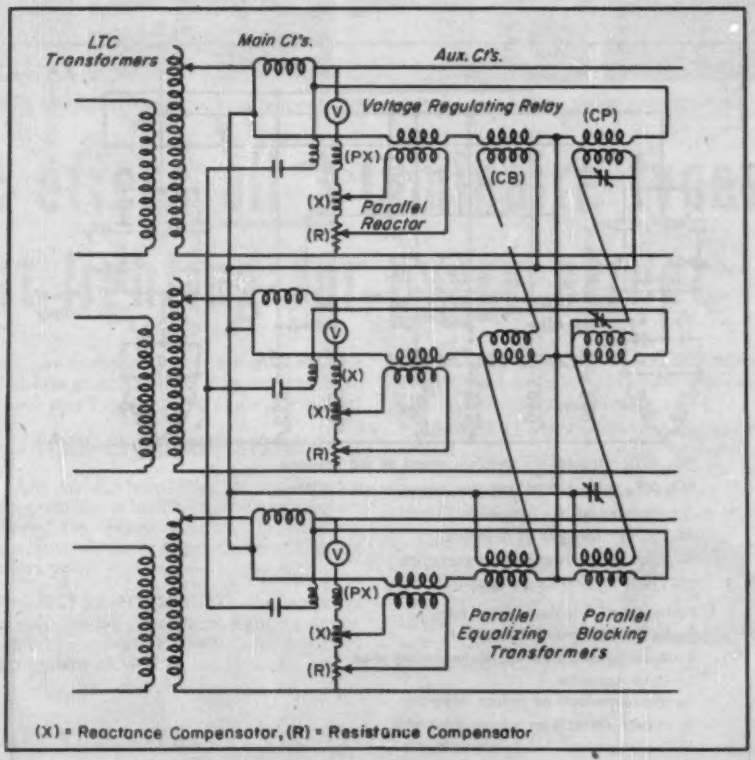
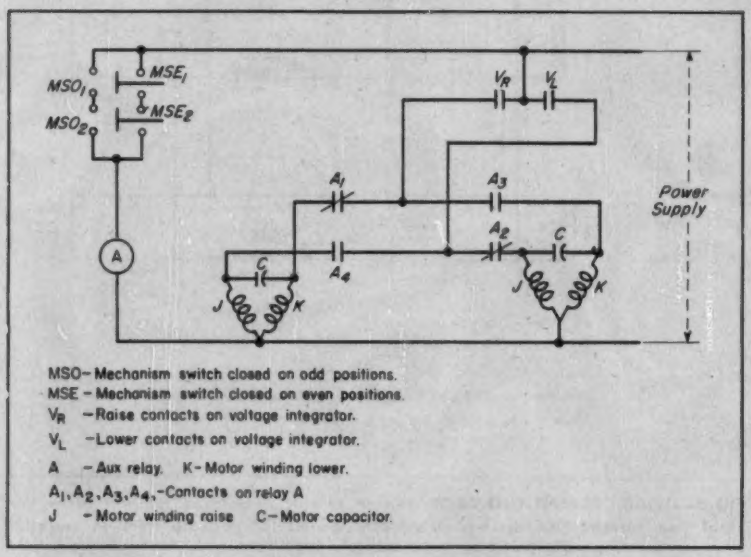


FIG 5—CURRENT-BALANCE circuit has been adopted as standard method of control so that equipment of different manufacturers may be paralleled readily

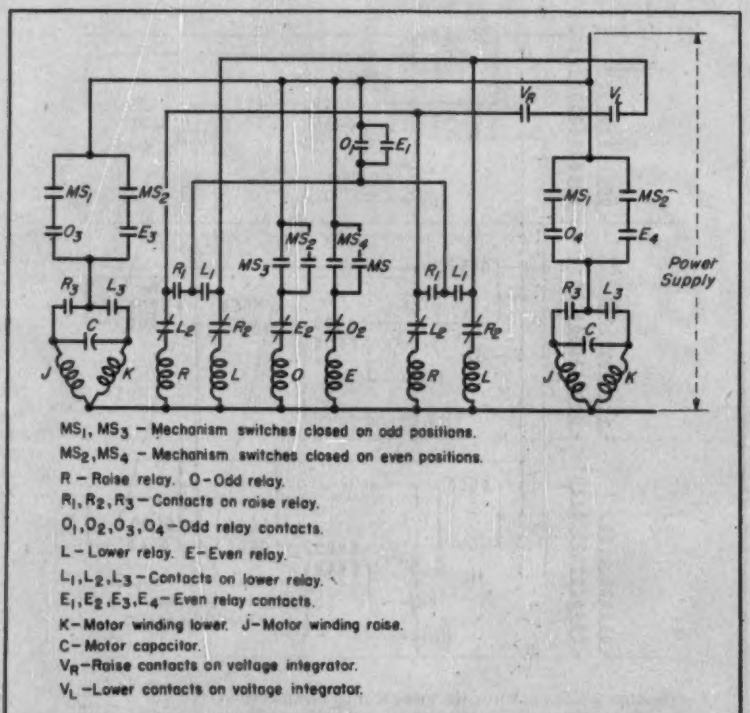
current to a permissible value.

Load current affects the voltage drop across the reversed-reactance relay. It causes the transformer to hold a decreasing instead of an increasing voltage with load. When load power factor is high and about constant at near full-load current, resistance compensation can be increased so that the transformer regulates either for constant voltage as load increases or rising voltage as load increases, to give constant voltage at the load center. When load power factor is low, or varies near full load, the voltage variation at the load center may be excessive. Some control scheme other than reversed-reactance compensation should be considered.



MSO – Mechanism switch closed on odd positions.
MSE – Mechanism switch closed on even positions.
V_R – Raise contacts on voltage integrator.
V_L – Lower contacts on voltage integrator.
A – Aux relay. K – Motor winding lower.
A_1, A_2, A_3, A_4 – Contacts on relay A
J – Motor winding raise C – Motor capacitor.

FIG 6—STEP-BY-STEP electrical interlock method keeps tap-changing mechanisms of transformers within one step of each other by relays in motor circuits



MS_1, MS_3 – Mechanism switches closed on odd positions.
MS_2, MS_4 – Mechanism switches closed on even positions.
R – Raise relay. O – Odd relay.
R_1, R_2, R_3 – Contacts on raise relay.
O_1, O_2, O_3, O_4 – Odd relay contacts.
L – Lower relay. E – Even relay.
L_1, L_2, L_3 – Contacts on lower relay.
E_1, E_2, E_3, E_4 – Even relay contacts.
K – Motor winding lower. J – Motor winding raise.
C – Motor capacitor.
V_R – Raise contacts on voltage integrator.
V_L – Lower contacts on voltage integrator.

FIG 7—LOCK-IN-STEP electrical interlock method is used to keep transformers in parallel exactly on same tap position except while taps are being changed

Reversed-reactance paralleling, however, is advantageous in that no special devices are needed in the voltage control circuit and no control interconnections between the transformers. The scheme is a popular one for paralleling LTC transformers at different stations. Its performance can be calculated.

In the cross-current method for controling LTC transformers, the CT of the first transformer is connected to the compensator of the second transformer and vice versa. This is illustrated in Fig 2. Circulating current through the compensators acts in the same manner as in reversed-reactance compensation to hold the transformer voltage ratios close together.

Control Leads Needed

This control scheme has the disadvantage of requiring control leads between the transformers. Also, when one transformer is removed from service, control connections must be changed so that the CT of the transformer in service is connected to its own compensator. The scheme has been used extensively for adjacent transformers in the same station.

Sometimes, three transformers are connected for current-balance paralleling. The current-balance portion of the circuit, holding the units close together in tap positions, is shown in Fig 3. Because secondaries of the parallel blocking transformers (CP in Fig 3) are in series, each current transformer carries equal current in its primary and secondary windings.

When main CT's carry different currents, due to the LTC transformers being on different tap positions, the difference between the average current of the three LTC transformers and individual LTC transformer currents circulates through reactance (PX), which is in series with the voltage control relay. Current in (PX) tends to cause the transformers, which are higher in voltage than the average, to move toward the

(*Continued on page* 124)

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MERCURY LUMINAIRES, often used to attain the higher illumination levels, are characterized by long lamp life, high lamp efficiency.

FLUORESCENT LUMINAIRES offer superior visibility, fine color, low glare, long lamp life, low maintenance, and low power consumption.

General Electric offers all 3 luminaire types to assure best lighting for every street

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Let G. E. help your street lighting program on a ***vision-engineered system*** basis. On every lighting project, regardless of size or type, General Electric offers you:

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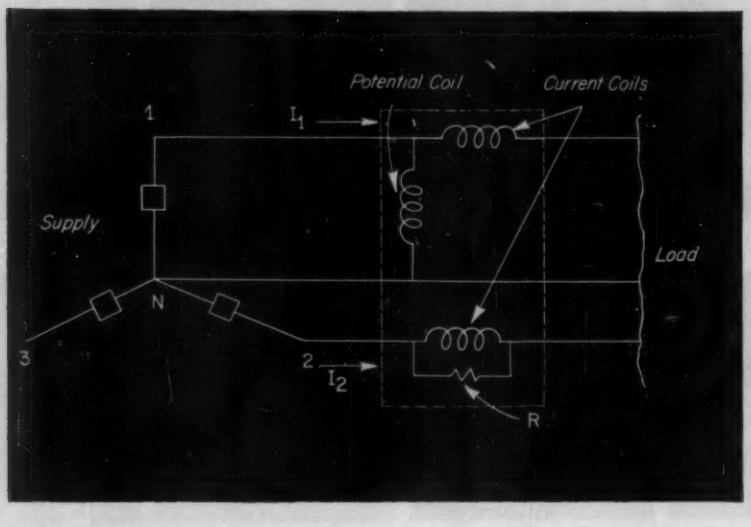
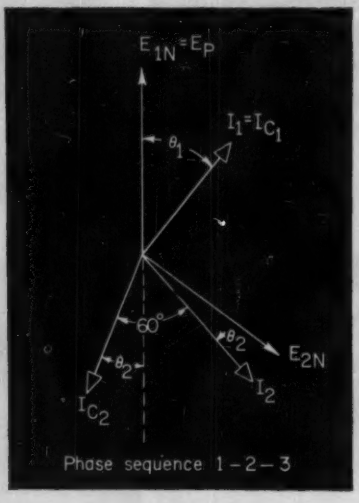




NEW ENGINEERING IDEA

1-Stator, 1-Rotor Unit Meters 4-Wire, 3-Phase

HUGH W. GRIFFITH Jr, Sales Mgr., Watthour Meters and Accessories, Sangamo Electric Co, Springfield, Ill.

A single-stator, single rotor watthour meter has been developed for metering a 3-wire connection from a 4-wire wye, 3-phase distribution system.

The service to be metered consists of a neutral and two lines, in which voltages are 120 deg apart and must be balanced and identified as to phase sequence.

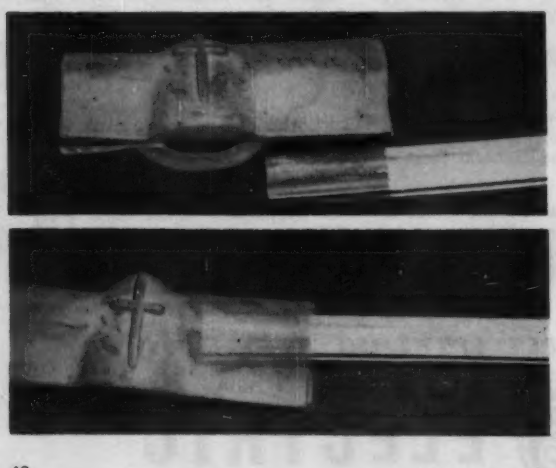
The meter would have one potential and two current coils, phase (line-to-neutral) voltage being applied to the former. The current coils, wound on a common magnetic yoke, would be connected in series with the two phases.

One current coil would carry line current in the conventional manner. The other would be so designed that current flow in it lags line current by 60 deg when shunted by a suitable resistor, as shown in Fig 1.

The exact lag angle would be obtained through the choice of inductance to resistance of the current coil itself. A magnetic shunt, spaced through from the main magnetic circuit, insures the proper value of inductance for this current coil. Angular relationships of the two coil currents and the voltage applied to the potential coil are as in Fig 2.

The same basic idea is applicable to measuring a 3-wire, 3-phase system, the only change required being a reversal in the winding direction of the shunted coil.

SAFETY



Red-End Hose Shows Peril

JAMES D. RICHEY and **PAUL F. McCAMMON**, Ohio Power Co, Portsmouth, Ohio

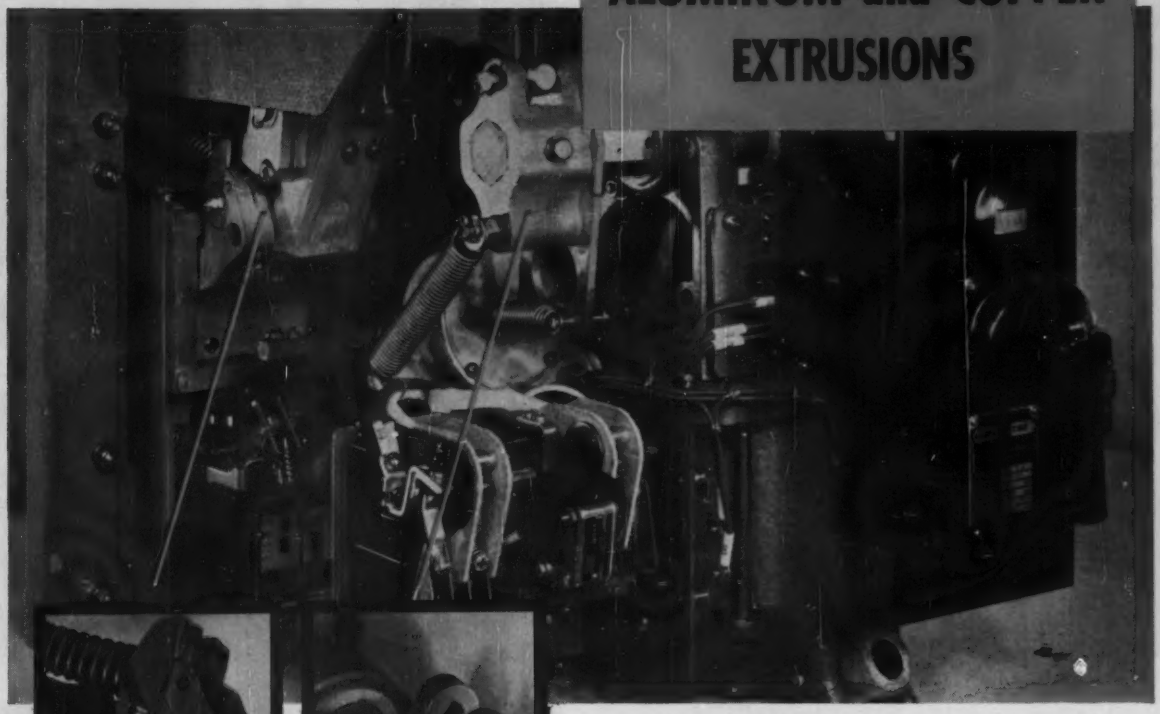
Many jobs around energized conductors require covering them and their insulators with appropriate line hose and insulator hoods. The end of line hose is usually inserted in the adjoining insulator hood or section of hose.

Unless the line hose is secured it may slip out of the adjoining hood or hose, leaving live conductor exposed where a workman could come in contact with it. When the customary black hose is used it is not easy to detect the start of hose displacement, or a slight separation

(*Continued on page* 72)

REVERE
ALUMINUM and COPPER EXTRUSIONS

I-T-E CIRCUIT BREAKER—KD (3,000 amp. rating) showing progressive assembly with Revere Copper and Aluminum Extrusions in place. I-T-E Circuit Breaker—KE is same type with 4,000 amp. rating.



COPPER
for conductivity

ALUMINUM
for economy

—form a Money-Saving team in latest

I-T-E CIRCUIT BREAKERS

Revere T. A. Service an Important Factor in Ultimate Design of Parts

The larger of the two extruded and drawn copper shapes shown at extreme left started out on the drawing board as two pieces. It was thought that a single shape of this size could not be made satisfactorily. At this point, I-T-E Engineers got together with Revere's T. A. (Technical Advisory) Service and threshed things over. The final result is the one-piece extrusion shown and a reduction in machining time.

Aluminum was selected for the other extrusion shown because I-T-E found that it cost less per pound of metal and had a higher strength ratio when compared to a casting. Also, space was a factor. In all, Revere supplies 5 copper and 2 aluminum extrusions for KD and KE type I-T-E Circuit Breakers. All were designed to fit specific requirements of I-T-E Engineers. Where it could be used satisfactorily, aluminum was applied because of economy, while current carrying members called for copper.

This is still another example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it aluminum, copper or any one of their alloys. So, with new things happening all the time in non-ferrous metals it can pay you to keep in close touch with Revere.

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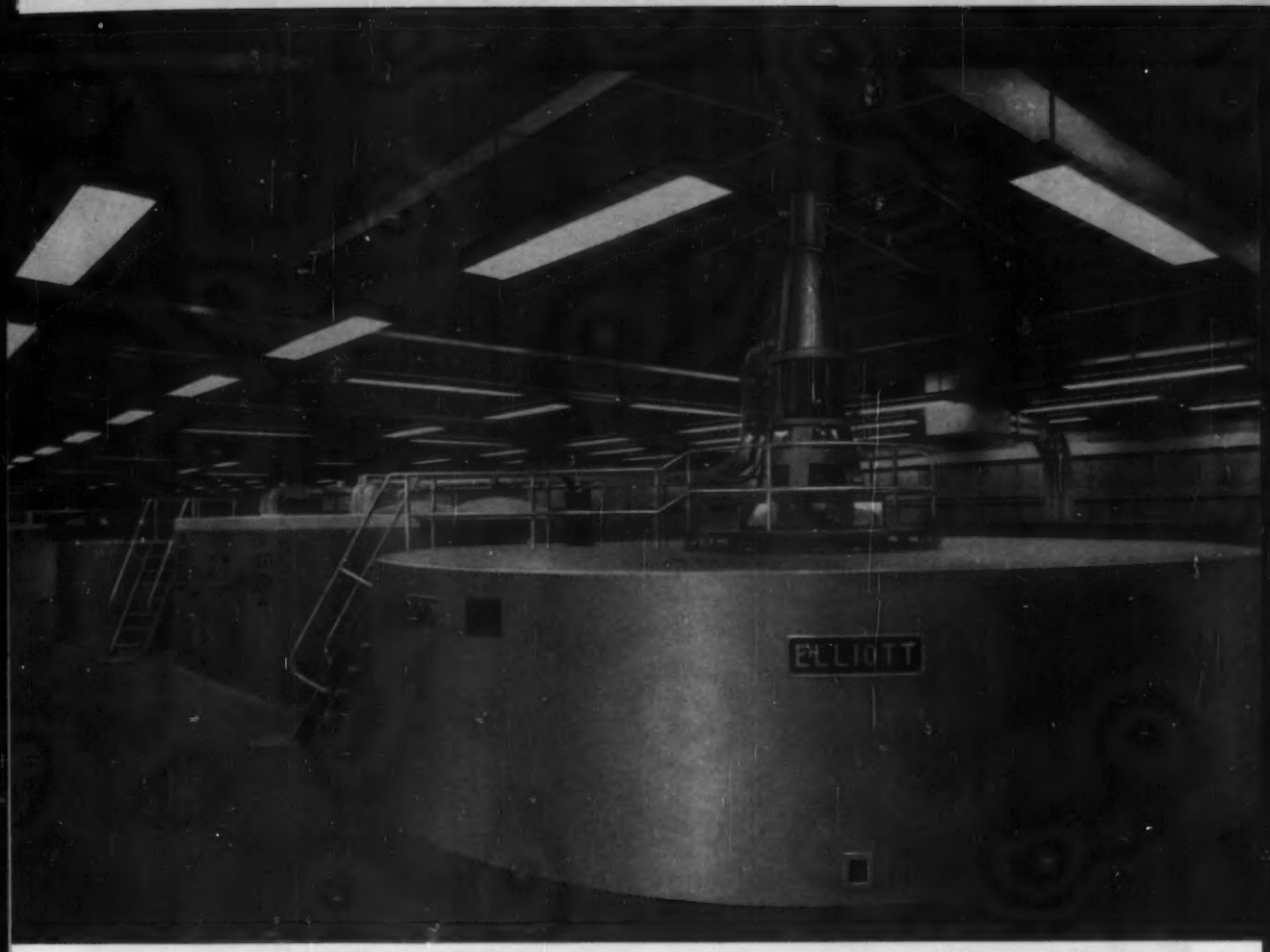
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

. . . in the
Pacific
Northwest

four more ELLIOTT generators add to the region's power supply!



Liberal generator design provides "bonus" revenue

The Box Canyon hydroelectric generating plant is one more example of how Elliott design and engineering reduces the cost of construction, installation, and operation . . . and in this case, resulted in "bonus" revenue.

Liberal design of the turbines and generators combined to provide an unusually high output power delivery. As a result, the four generators, each nominally rated at 15,000 kw, 100 rpm, 60 C rise are delivering in excess of 75,000 kw under the same temperature-rise conditions. Since three-quarters of the station's capacity is sold to other utilities, this provides welcome extra income for the owner, Public Utility District No. 1 of Pend Oreille County, Washington.

The hydro station was erected on the picturesque Pend Oreille River located in a valley between two ranges of the Selkirk mountains, seen at the left. The plant features economical single-story design with roof hatchways above each of the generators. A gantry crane is available to handle routine inspection and maintenance. Plant and dam were designed by Harza Engineering Company, Chicago, Illinois.

Three of the four Elliott umbrella-type vertical generators are seen above. They were engineered by Elliott to achieve compact design, to reduce machine height, and to give pleasing appearance. Large doors between arms in the lower bracket afford access to the Kingsbury bearing for inspection of shoes. Here is another illustration of how Elliott generator engineering provides liberal design, high efficiency, and long-term dependability. For literature, call your Elliott representative or write . . .

ELLIOTT Company
RIDGWAY DIVISION
RIDGWAY, PENNSYLVANIA

NEW—

hydro-generator bulletin

describes construction features

This well-illustrated booklet—just printed—describes the important electrical and mechanical design features of Elliott generators.

shows typical installations

Includes pictures of umbrella and suspended-type vertical generators, large and small, as well as horizontal hydro-generators.

Ask for your copy Today!

B7-13

Red-End Hose Shows Peril (*Continued from page 68*)

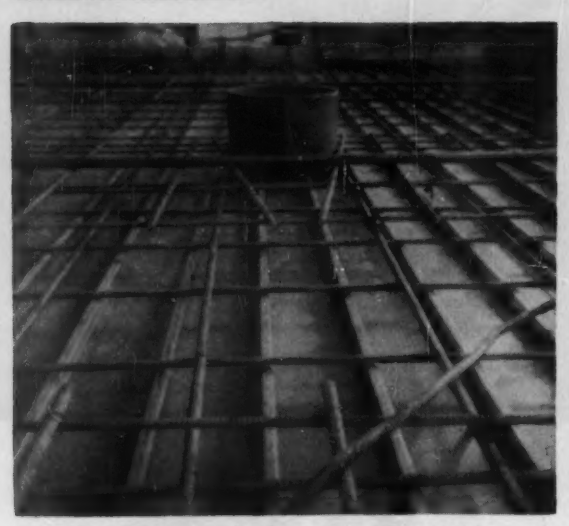
of adjoining sections of rubber protection.

Red-end hose, which is commercially available, eliminates the hazard by providing a warning when the end starts to slip out of adjoining sections. Its use is warranted as a safeguard of life and a stimulus to efficient work.

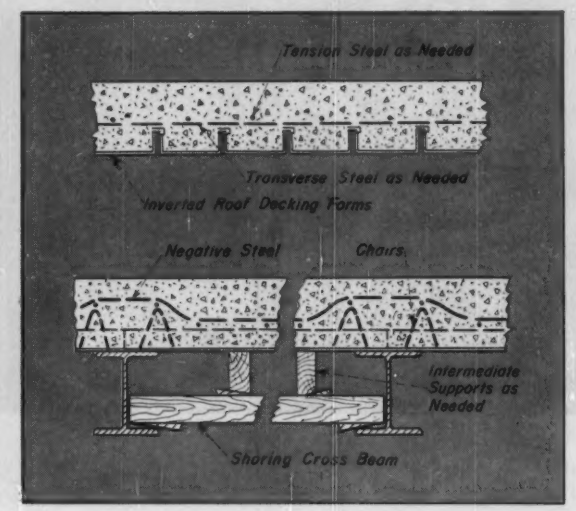
The red end is the part inserted. As long as the red warning does not show, linemen know that the protection is continuous, and an occasional glance is sufficient assurance. When a red end begins to appear, the linemen have a positive warning that the hose is slipping and must be immediately replaced.

When commercial red-end hose is not economically warranted, painting the ends of the usual hose provides the warning. A non-conductive red paint doesn't harm the rubber protection equipment.

GENERATION—Construction



ROOF DECKING, with interlocking flanges pointing up, is used as forms for pouring concrete floor in power plant



SHORING wedged between permanent structural floor framing provides additional support during curing of concrete

Steel Roof Decking Cuts Concrete Floor Costs

A. J. ORMSTON, Chief Mechanical Engineer, Florida Power Corp, St. Petersburg, Fla.

Steel roof decking is used by Florida Power Corp in lieu of plywood and wood joists as forms for reinforced concrete operating floors in power plants. Although the decking becomes part of the floor and, thus, increases material costs, overall costs are cut 29% by reductions in labor and waste material.

The roof decking is of 20-gauge vinyl-primed channel-shaped steel and has interlocking flanges. It is placed on top of permanent structural-steel floor framing in an inverted position, flanges pointing up, and becomes an integral part of the floor when concrete is poured.

Temporary shoring for additional support during curing of concrete is provided in two ways. Decking is either supported on wood beams, jacks, and framing erected from the level below or on wood beams resting on the lower flanges of the permanent I-beam flooring framing. In the latter case, intermediate supports are wedged between the wood beams and the decking.

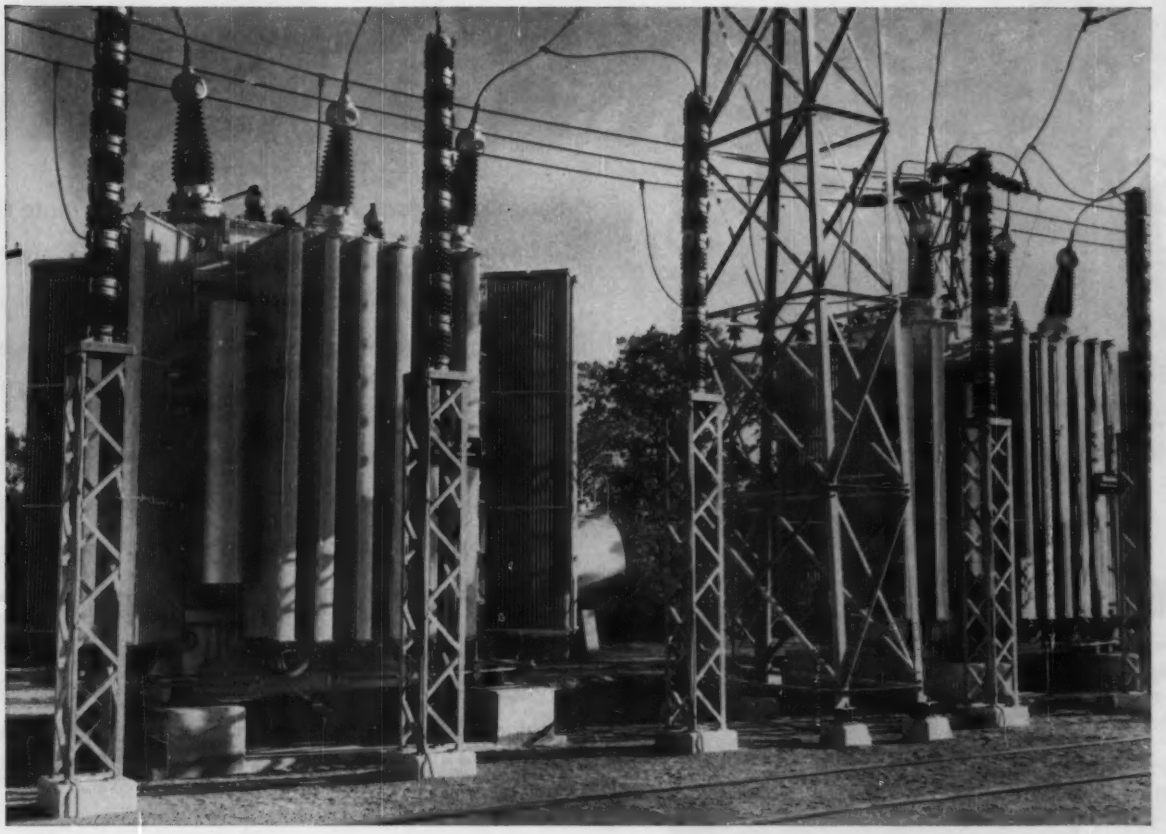
Used at Suwannee

About 10,000 sq ft of metal decking was used as concrete forms at the Suwannee River plant for Unit No. 3, which will go into service this year. This application of decking cut manhours by 46% and labor costs by 58%, but increased material costs 52%. Overall costs, though, were reduced 29% compared with temporary plywood forms.

Moreover, because the decking was ordered to exact size, waste was negligible, and appearance of the underside of the floor is much more uniform and attractive.

For future concrete flooring jobs the company is considering utilizing the cross-sectional area of the decking as positive reinforcement. This would reduce the requirements for reinforcing bars and effect additional savings.

WAGNER TRANSFORMERS . . . THE CHOICE OF LEADERS IN INDUSTRY



New Wagner-equipped substation adds system capacity for Alabama Power Company

Utility company planning to meet increasing residential loads calls for ever-increasing capacity and more and more transmission and distribution substations.

Alabama Power Company has recently completed the installation of two new Wagner power transformers at its North Auburn Substation. These transformers are rated 22,500 kva, 110,000 to 69,000 volts, 3 phase, 60 cycle.

The choice of Wagner Transformers for this installation points up the fact that more and more power companies are looking to Wagner for their transformer needs.

Wagner builds standard and special power transformers to meet practically all kva and voltage requirements. You might consider taking advantage of the savings in time and dollars by specifying Wagner standardized units for medium sized transformers. Check ASA Standards C57.12.

Consult Wagner about your next power transformer installation. 32 branch offices are at your service. Wagner Bulletins TU-181 and TU-16D tell the whole story. Write for your copies today.

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SANGAMO CAPACITORS

Sangamo's power capacitor engineering is more than skin deep. It's so complete and thorough that all designs have assured factors of safety to meet every operating condition. Insurance that Sangamo power capacitors will give better performance—longer life.

Extensive high voltage test facilities enable establishment of better than usual 60 cycle withstand and impulse voltage levels. Fully instrumented, precise powered heat run tests give the facts for optimum design with low operating temperature—and continuing life tests under actual operating conditions provide the final criterion for well-balanced liberal design.

High-voltage test berth includes equipment for 60 cycle withstand tests, impulse tests and corona measurement.

..long life assured

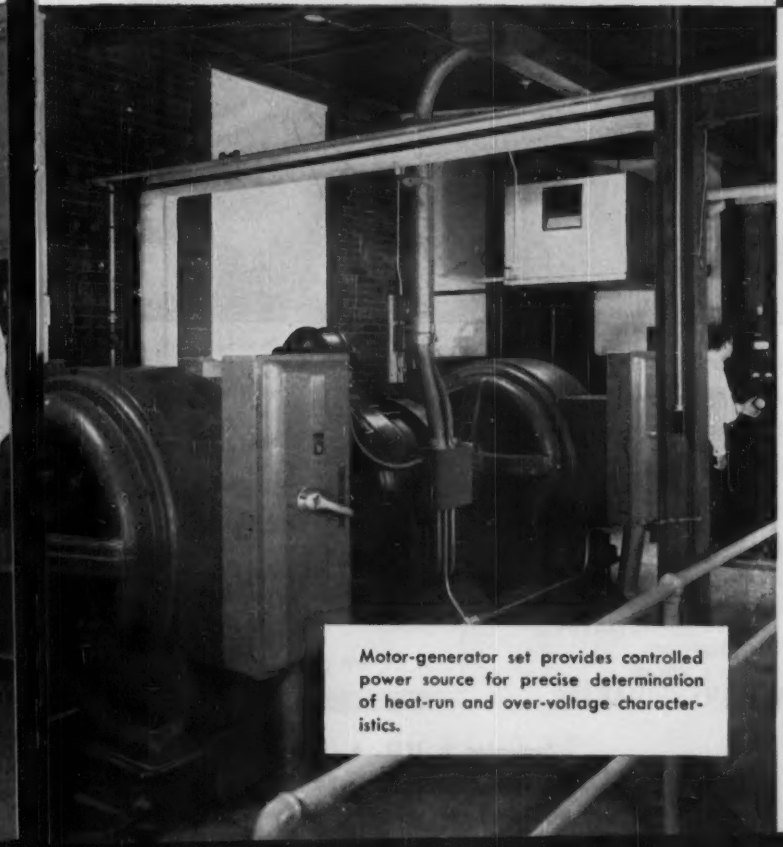
These test facilities, combined with Sangamo's many other facilities and advanced manufacturing methods, give you full assurance that Sangamo power capacitors will be your best buy.

Fine engineering and manufacturing facilities are among the reasons why inspection of Sangamo manufacturing operations by power engineers from a large number of the country's major utilities has resulted in unqualified product approval. Why many have said "This is the best capacitor operation I have ever seen."

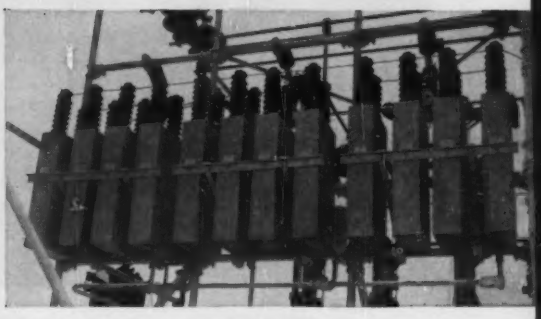
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

PC57-4

Special test setups duplicate service installations. Here pole-type equipment is checked for mechanical construction, electrical clearances and operating temperature characteristics.



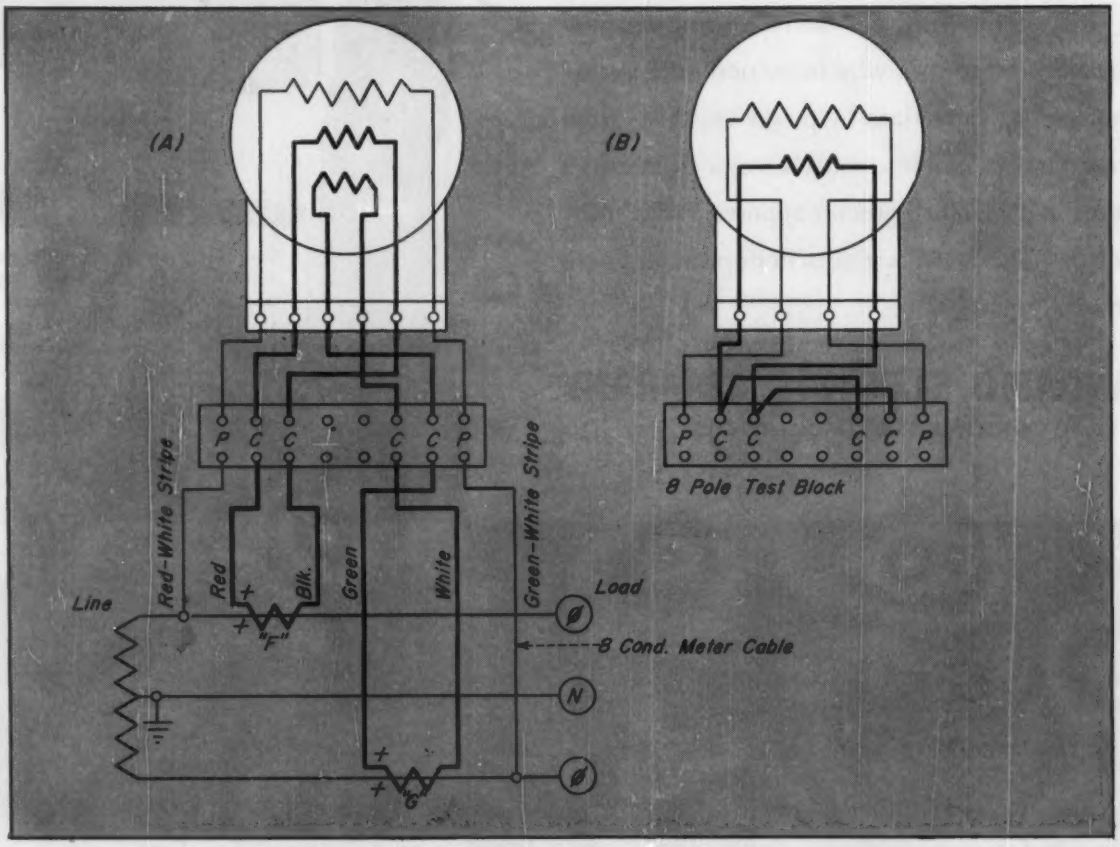
Motor-generator set provides controlled power source for precise determination of heat-run and over-voltage characteristics.



Capacitors designed for assured long life in a highly contaminated area feature stainless steel cases and specially designed "high creep" bushings.

Metering 1-Ph 3-W Service Over 100 Amp

Connections are given for single-phase, three-wire, 240-volt service over 100 amperes using two two-wire current transformers and a single-phase watthour demand meter. These wiring instructions are an adaptation from Distribution Standards of Alabama Power Co.



+ Indicates polarity mark
(A) 2.5-amp, 240-v, 1-ph, 3-w, 6-terminal watthour demand meter
(B) 2.5-amp, 240-v, 1-ph, 2-w, 4-terminal watthour demand meter

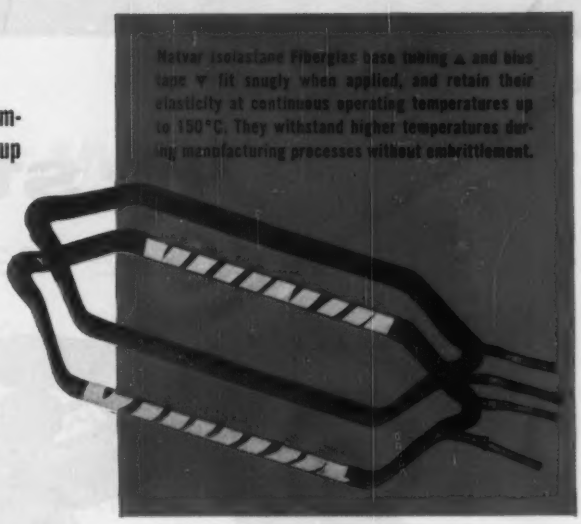
Notes:
Current transformers F and G are same ratio. Kwhr dial constant is ratio of current transformers for meter A and one-half ratio of current transformers for meter B

For outdoor installations use meter box

New NATVAR ISOLASTANE* TUBING and TAPE

✓ **HEAT RESISTANT** —for continuous performance at temperatures up to 150°C

✓ **RESILIENT, ELASTIC** — for sharp bends and irregular surfaces


Natvar isolastane Fiberglas base tubing ▲ and bias tape ▼ fit snugly when applied, and retain their elasticity at continuous operating temperatures up to 150°C. They withstand higher temperatures during manufacturing processes without embrittlement.

*ISOLASTANE *is Natvar's new elastomeric isocyanate type coating for Fiberglas braid and tape. Registration pending.*

Natvar

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- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
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- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Isoglas® sheet, tape, tubing and sleeving
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

Natvar Isolastane is now making important savings possible. It makes it unnecessary to use expensive Class H materials to solve temperature problems during the manufacture of products which do not require Class H rating.

Isolastane is outstanding in its

- ELASTICITY (EXTENSIBILITY)
- RESISTANCE TO HEAT
- RESISTANCE TO CRAZING AND CRACKING
- RESISTANCE TO SOLVENTS, INCLUDING THE ASKARELS
- TOUGHNESS AND ABRASION RESISTANCE
- WET DIELECTRIC STRENGTH
- LOW TEMPERATURE FLEXIBILITY
- FUNGISTATIC QUALITIES
- ADHESION TO GLASS

Full technical data and samples are available on request.

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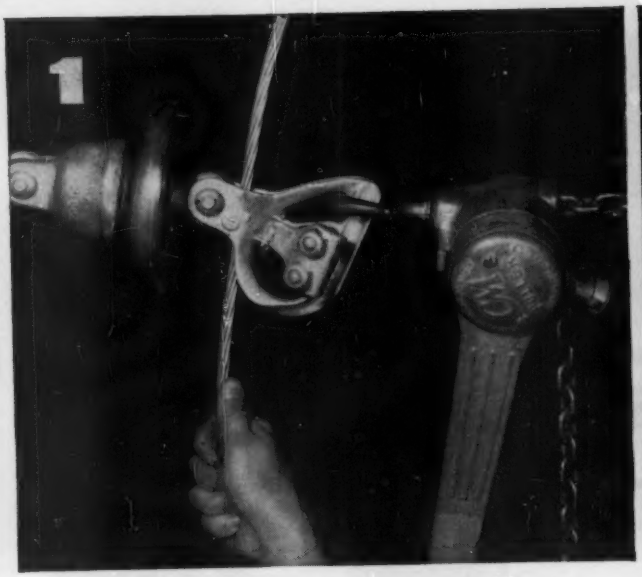


It stays open

while you work

SPRING HOLDS KEEPER OPEN IN NEW UNIVERSAL CLAMP..... IT HAS NO LOOSE PARTS AND ALIGNS AUTOMATICALLY

This new O-B Universal clamp helps save time at two key steps in deadend installation . . . during forming of the cable bend and during tightening of the clamp.

A spring clip holds the keeper jaw open until nuts are tightened. The lineman can use both hands for forming the conductor. The clamp automatically stays in alignment, and continues to stay in alignment during the tightening operation as the lineman holds the conductor in place with one hand and tightens the clamp with the other. All the work is done from one side of the clamp.

It's easy to see how much simpler this clamp makes the lineman's job. He doesn't have to worry about loose nuts, bolts, washers, or keeper pieces. He can form the bend neatly and quickly without help, and without having to worry about the position of the clamp and its keeper.

Made of galvanized malleable iron, this new clamp takes the full range of conductor from .20 to .50 inches in diameter. Be sure to ask for it on your next order. It certainly will make deadening more convenient and more effective.

474-H

Ohio Brass

OHIO BRASS COMPANY, MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Seeds to Oats to Cows—Electrically in 6 Days

Texas dairymen grow forage indoors by using heat pumps to supply ideal climate

In Texas they're growing oats eight inches high in six days . . . . and they're doing it electrically!

The "oat growing machine," called "Herbagere," is being used chiefly to grow food for dairy herds. It comes in two sizes, one for 20-cow herd, the other for a 40. The small unit has 60 growing trays and the larger 120.

These trays are filled with 4½ to 5 lb of grain seed which is soaked overnight to speed up germination. During the six-day growing cycle the grain is fed water and chemical plant food.

Here's where the kwhr come into play: In order that the grain may produce maximum growth (37-38 lb of green oats from the 4½ to 5 lb of seeds), ideal temperature and humidity conditions must be maintained. These are 72 F and 70% relative humidity.

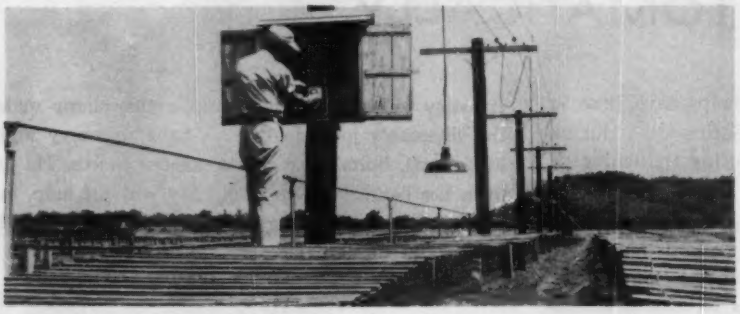
For the small machines, a one-ton window air conditioner with a resistance heating element or a one-ton heat pump is used. For the larger units, a two-ton A.C.'er with 6.6 kw of resistance heating is used, or an equivalent capacity heat pump.

But that's not the end of the load. Light energy for plant photosynthesis is required. This comes from fluorescent and incandescent lamps.

Users of Herbagere like it. A large unit on the Ross Conway dairy farm near Crowley, Texas, produces forage for 35 cows. The units uses an average 30 kwhr daily, with a peak demand of about 7 kw. Says dairyman Conway, "The Herbagere is one of the best things I ever bought. Forage from the machine 'conditions' a cow, and enables her to do her best."

TRAY OF GROWING OATS is inspected by Central Power & Light's C. E. Bean. Units will feed herds up to 40 cows

The Calhoun dairy farm near Falfaurria's, Texas, on Central Power & Light Co's lines, uses a small unit for its herd. Machine costs about $3,000, and is expected to pay for itself in 18 months.



TVA Test: Boost Pine Growth with Light

Tests now going on at TVA hold a dual promise for electric utilities: (1) Increased rural load, and (2) a plentiful supply of white pine for future pole needs. At its nursery in Clinton, Tenn., TVA is attempting to speed the growth of white pine seedlings by using light. Ordinarily, the seedlings require two seasons before they are large enough to plant. With light, TVA hopes to do it in one.

In the experiment, two 300-w lamps are used in each of ten plots in a 400-ft bed. Lighting intensity at the center of the plot is 120 ft-candles, and drops off to zero at the edges.

TVA stresses the installation's experimental nature. If it works, the problem will be to light five or six acres. Then load and power consumption will then become important.

FBE Materials Available

FARM BETTER ELECTRICALLY promotional materials are now available. Materials to date consist of stickers and decals for windows, trucks, and other display areas. An Industry Booklet is also ready; it explains; how Farm Better Electrically can help America's farmers. Write Farm Better Electrically Program, Room 2626, 420 Lexington Ave, New York 17, N. Y.

(*More Selling on page* 82)

Get 3 Tanks (A Tank Per Phase)

Even on Outdoor Distribution Breakers

Don't be 1/3 Safe!

● Be completely safe! Buy breakers that offer positive protection for today's low reactance systems with their corresponding high fault currents. Three tanks, not just one, provide maximum protection.

Enjoy this big breaker type protection in outdoor distribution breakers at no extra charge. Other big breaker features include: AEIC-NEMA standardized control wiring; two vertical breaks per phase, using time-tested *Ruptor* devices; self-aligning, self-wiping tulip and bayonet contacts.

Ask for Bulletin 71B7946 for the complete story. Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Ratings: 14.4 kv, 100 and 250 mva

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-5146

New adapter shank bit

fits either hand brace or power drill

Taper square shank fits hand braces

Cut off taper and use "hex" shank in both power drills and hand braces

Cut your wood bit inventory by 50%

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers

Wilmington, Ohio

Washington U. Backs Electric Heat Meet

Electric heating conference, to cover both heat pumps and resistance heating, is for architects and consulting engineers

Washington University, St. Louis, Mo., will be the site of a two-day electric space heating conference on Oct. 1-2. The conference is sponsored by University College and the Department of Mechanical Engineering, Washington University, with the St. Louis chapters of American Institute of Architects, American Society of Heating & Air Conditioning Engineers, and American Society of Refrigerating Engineers. It will cover both heat pumps and electric resistance space heating.

Largely the result of efforts of Union Electric Co, the conference is set up to acquaint architects and engineers with opportunities, advances, and other qualities of electric heating. Recognized leaders in their respective fields will deliver papers on such subjects as the present status of electric heating; importance of insulation; residential and commercial heat pump and resistance heating applications; heat loss calculation methods; and other phases of climate control.

Speakers will deal with application principles rather than specific products. The fact that the conference is held on a university campus, with the sponsorship of both the university and professional engineering societies reflects an increasing recognition of electric heating as being practical and competitive with other fuels.

COMPETITOR'S CORNER

Servel Sells Its Gas A. C. Division

In a recent proxy statement, stockholders of Servel, Inc, were advised that the company's All-Year Air Conditioning Division had been sold to Arkansas Louisiana Gas Co, Shreveport, La. Sale is subject to stockholder's approval. Total sale price is about $4 million; this includes about $1 million for the inventory of the All-Year Air Conditioning Division, and $3 million for other property and assets.

Permission is also being asked of the stockholders for authority to sell the remainder of Servel's assets when an advantageous arrangement can be made. This includes property used primarily for the company's Home Appliance Division, valued at about $5 million.

To Acquire New Business

Louis Ruthenberg, Servel board chairman, and D. C. Menzies, president, told stockholders that proceeds from the sale would be used to acquire businesses "of a more stable character."

Messrs. Ruthenburg and Menzies stated: "The board of directors is of the opinion that it is expedient and for the best interests of the Company and its stockholders that the Company dispose of . . . the property and assets . . . to the end that the proceeds thereof, together with other funds of the Company and additional funds if required and available, may be used . . . to acquire a new and different type of business which will afford the Company and its stockholders a reasonable return . . . on their investment."

According to the proxy statement, the company has had exploratory discussions with several possible purchasers of the Home Appliance Division; no definite understandings have been reached.

(More Selling on page 84)

Consider

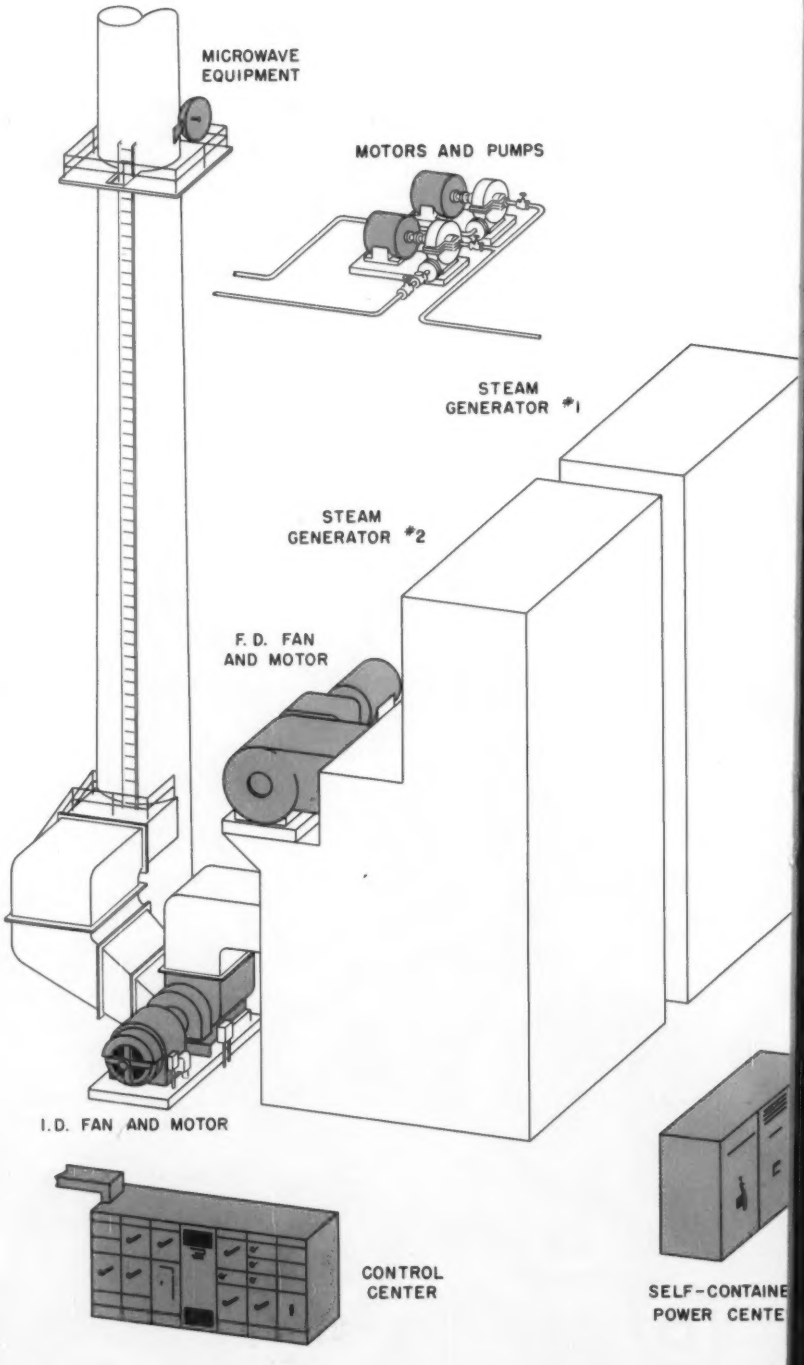
the advantages of one responsibility for your next power station!

Tom Fort, Vice President,
Apparatus Division,
Westinghouse Electric Corporation

Westinghouse apparatus available for power plant applications

Air Conditioning Equipment
Arc Welders
Atomic Reactor and Auxiliaries
Automatic Dispatching Equipment
Battery Chargers
Bus Duct
Circulating and Condensate Pumps
Control Boards
Control Centers
Coupling Capacitors, Line Traps and Potential Devices
Crane Motors and Controls
Cypak* Annunciators
Disconnecting Switches
Elevators—Passenger and Freight
Evaporators
Fans
Feedwater Heaters
Gear Speed Increasers
Gear Speed Reducers
Generators, Main and Auxiliary
Generator Voltage Regulator
Group Phase Bus
Instruments
Instrument Transformers
Isolated Phase Bus
Lighting Equipment
Lightning Arresters
Meters
Microwave Equipment
Panelboards
Precipitron®
Power Centers
Power Circuit Breakers
Powerhouse Motors
Power Line Carrier and Tone Equipment
Reactors, Current Limiting
Relays
Self-Contained Power Centers
Standard Motor Controls
Steam Condensers
Steam Jet Air Ejectors
Supervisory Control
Surge Protection Equipment
Switchboards
Switchgear
Switchyard Structure
System Grounding Equipment
Telemetering Equipment
Transformers, Main and Auxiliary
Turbines, Steam or Gas, Main and Auxiliary
Unit Heaters
Ventilating Fans
Water Coolers

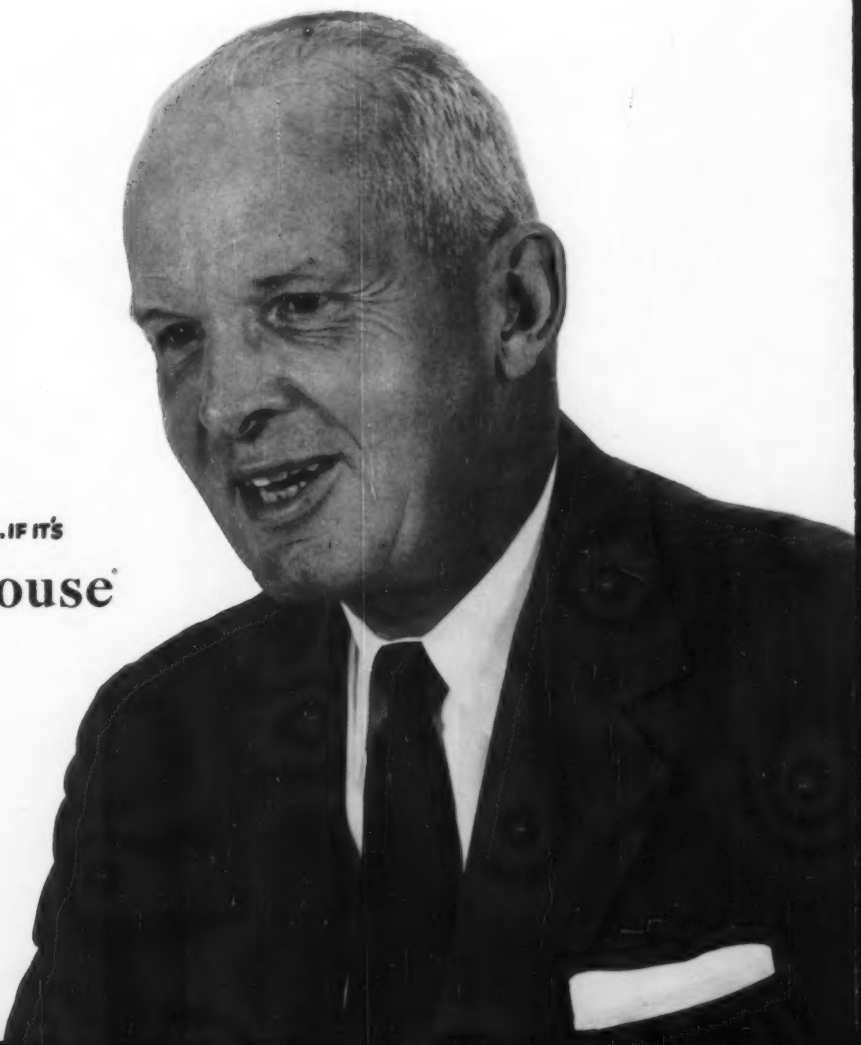
*Trade-Mark



Westinghouse can supply all this powerhouse equipment

Think of the time, trouble and processing you can save with:

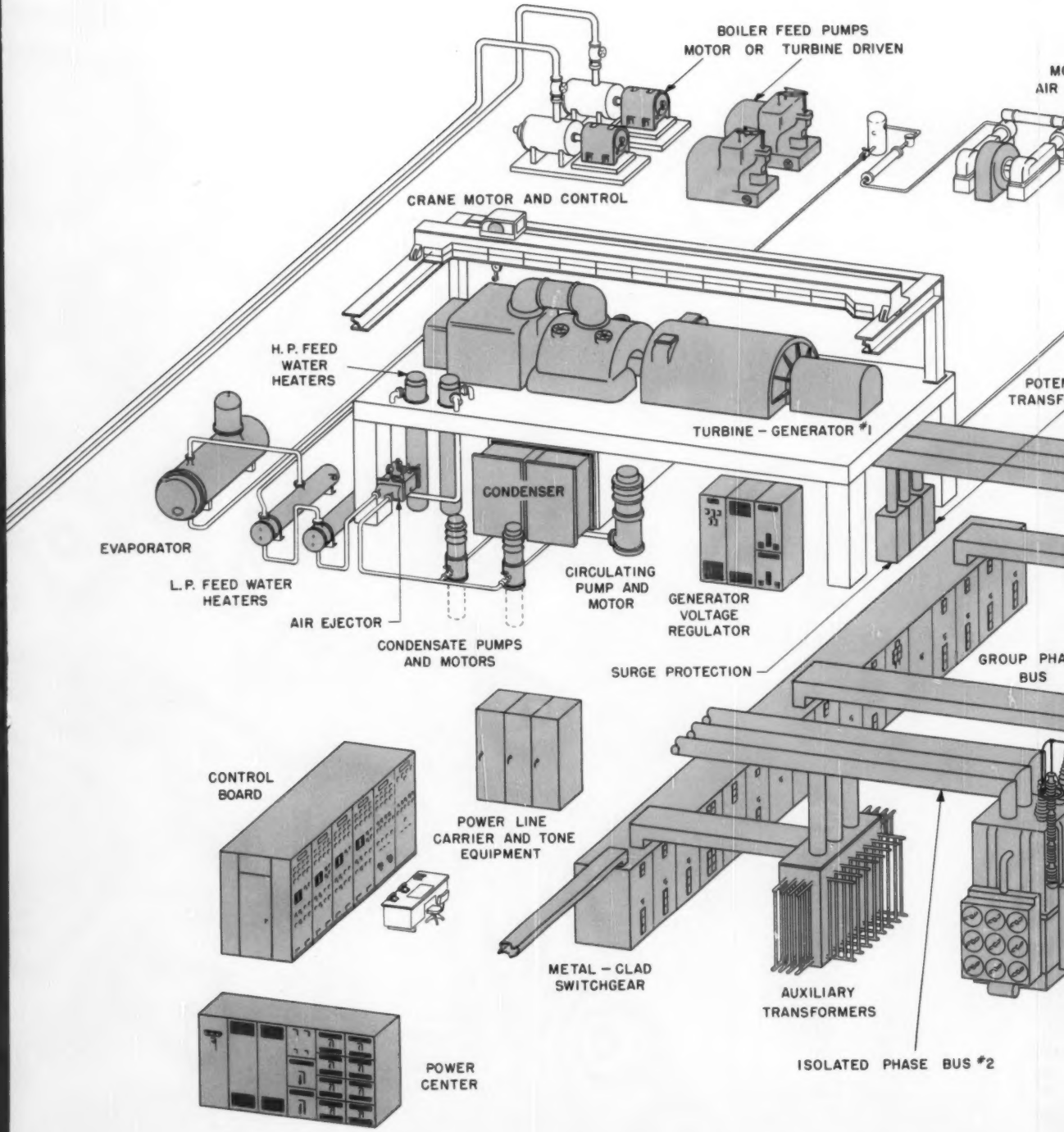
ONE ORDER
ONE CONTACT
ONE RESPONSIBILITY



YOU CAN BE SURE... IF IT'S

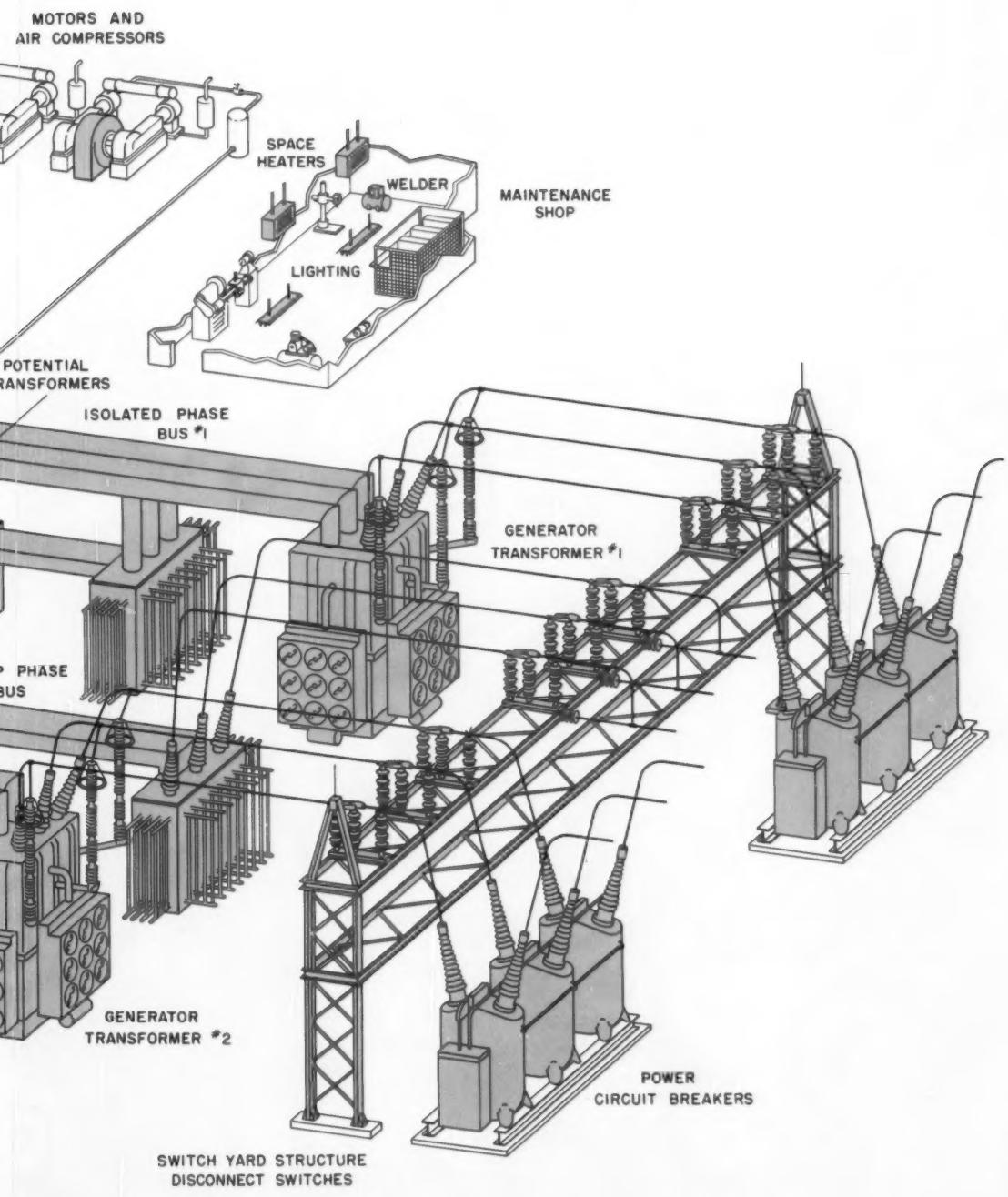
Westinghouse

ONE ORDER, ONE CONTA



A print of this artwork, suitable for framing, is availale free of charge; write Westinghouse Electric Corporatic n, Box 868, Pittsburgh 30, Pa.

TACT, ONE RESPONSIBILITY



When you place an order with Westinghouse you take advantage of a unique organization

FOREMOST IN RESEARCH

Westinghouse research leads the industry, probing for new knowledge.

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Product development is the practical application of Westinghouse research.

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Noted for engineering excellence, Westinghouse has a depth of experience that can be gained only through years of *living* the problems of the electrical industry.

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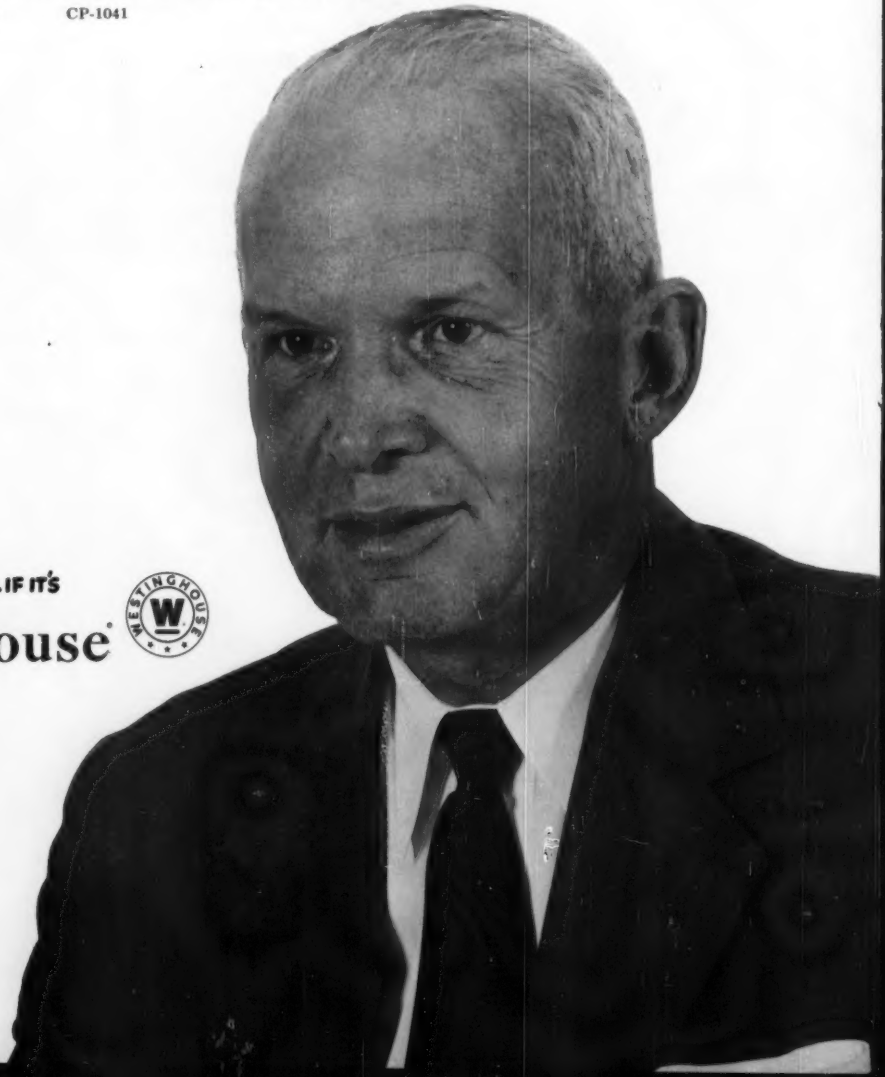
The broad scope of Westinghouse stands ready to cooperate with you and your consultants. Your orders to Westinghouse not only take advantage of all this research, development and engineering, they support it, too. One man, your local Westinghouse representative, is your key man to it all. CP-1041



YOU CAN BE SURE...IF IT'S

Westinghouse®

Contrast between new and old lighting systems shows in photo taken halfway through changeover. Slimline industrial fluorescents maintain 50 ft-c on left side of shop. 200-watt incandescents on right produce only 10 ft-c

Lighting Lifts Crane Output

L. L. SWEETLAND, Industrial Lighting Engineer, New York State Electric & Gas Corp., Elmira, N. Y.

A new lighting system that grew out of a utility lighting conference has increased production, reduced errors, and boosted employee morale in the machine shop of the Shepard Niles Crane & Hoist Co, Montour Falls, N. Y. The well-engineered fluorescent lighting has produced a 600% increase in the night time lighting level and up to 300% in the daytime illumination.

Plagued for some time with inefficient lighting, Superintendent Harold Lunger obtained approval from President Sydney Buckley to make the change when they discovered that the existing incandescent lighting system produced only about 10 foot-candles, compared to the recommended minimum of 50 ft-c of glare-free illumination for this type of work. Although windows and skylights produced an additional 10 to 15 ft-c on a bright, clear day, this light was variable and not available for night work.

Lunger's assistant, Wellington Martin, made the measurements while attending a lighting conference being held by New York State Electric & Gas Corp for its industrial customers. The utility had lent lighting meters to the conferees to familiarize them with measurement techniques and allow them to make their own illumination level checks. A manual of lighting fundamentals, issued to all participating, supplied the recommended lighting levels. A utility representative was called in to make the actual system design.

Since 12 feet was the maximum permissible mounting height, fluorescent lighting was selected. The installation includes 56 fixtures, with two, 96-inch, T-12 lamps in each. Installed in eight rows, they are mounted on 8.5-ft centers between the rows and 10-ft centers along the rows. Although continuous rows would have reduced wiring costs slightly, the spacing between the fixtures made it possible to avoid pipes and ducts.

To throw some light on the ceiling and eliminate the cave-like appearance of the shop, a fixture with a 25% upward component was chosen. Since most of the machine operators view the fixtures from the side, a light finish was used on the outside of the fixtures to relieve the contrast between them and the ceiling. Louvres with 35% crosswise and 25% lengthwise shielding reduce glare and cut fixture brightness. With the present color of ceilings and walls, the installation will maintain a 50-ft-c level in the shop, although the initial level is higher.

The old system used 30 incandescent fixtures, each with a 200-watt lamp. Although the fluorescents have increased power consumption about 100%, the effect has been so great that plans are being made to increase transformer capacity to permit similar improvements in other parts of the plant. The Shepard Niles management is convinced their new lighting was a good investment. As Superintendent Lunger puts it, "The men started grinning after we had the first fixture installed and they haven't stopped since."

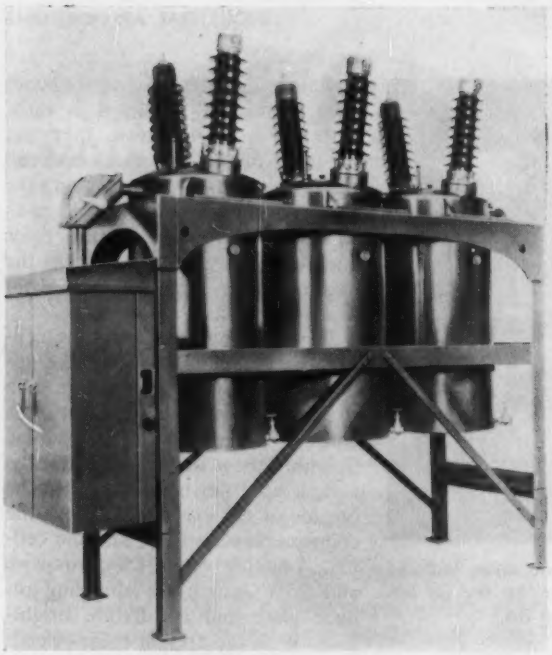
Hot Wire Cuts Curves in Foam

GEORGE C. WAGNER, Industrial Power Engineer, Union Electric Co, St Louis Mo

A heated length of nichrome wire provided a simple and novel method of cutting plastic foam for the Hadley Brothers Uhl Company in St Louis, Mo. The company manufactures a variety of polyurethane foam products. Outside shapes of some of the products must be cut to contours that approximate sine waves or square waves.

The material comes out of the curing oven in blocks that measure approximately 54 inches wide by 25 feet long and are 6 to 10 inches deep. The blocks are placed on a conveyor across which a straight nichrome wire is strung. A Variac, attached to the wire, controls its temperature. The wire can be raised and lowered at any predetermined rate and in a variety of sequences. As the conveyor feeds the block of polyurethane foam past the heated wire, the up and down motion produces the type of surface contour desired.

NEW EQUIPMENT



Oil Circuit Breakers . . .

. . . use drop-bar contact structure, simplified mechanical linkage, and hydraulic operating mechanisms. The frame-mounted breakers are designed for 23, 34.5, 46, and 69-kv services. Standard type 0 interrupters use oil condensation principle to prevent arc re-ignition, minimize pressure buildup and oil deterioration. Individual units are linked to drop-bar mechanism.

Drop-bar design reduces number of parts, simplifies maintenance. Contact blades are hard-drawn copper, tipped with silver-tungsten. Six-leaf contact shoes keep contact pressure uniform, have wide adjustment range.

Ratings range from 23 kv, 500 Mva to 69 kv, 2,500 Mva with 5-cycle opening and 20-cycle reclosing.

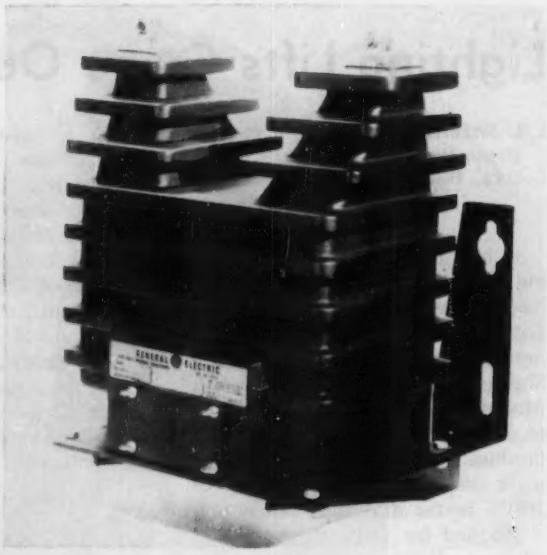
Pacific Switchgear Div, Federal Pacific Electric Co, 5815 Third St, San Francisco 24, Cal.

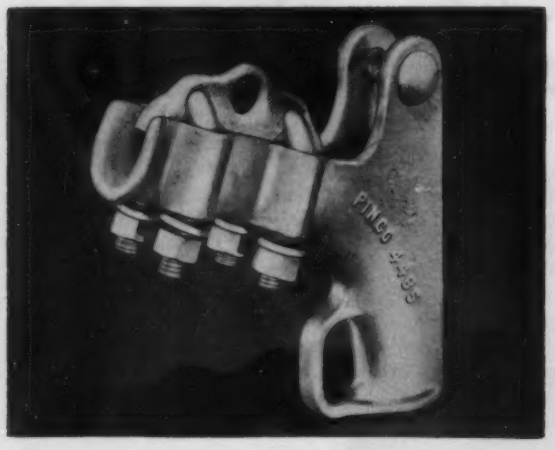
Molded Potential Transformers . . .

. . . are made for indoor and outdoor circuits up to 5 kv. Two new butyl-molded types replace four older potential transformers, with increases in thermal capacity and toughness and drops in size and weight. The new transformers carry 600 va at 30C ambient without overheating, and have a 60-kv impulse level. Ratios of 20:1, 35:1, and 40:1 are provided for line-to-line or line-to-neutral use in 4800-v systems and lower.

Outdoor type has stainless steel accessories and greater creepage distance. Both types are fire and explosion resistant, and have a low, stable insulation power factor due to low moisture absorption of the butyl.

General Electric Co, Schenectady 5, N. Y.





Distribution Strain Clamp . . .

. . . has a lift-off eye built into the keeper, making it easier and safer to work the line "hot". Clamp L4485 is made of hot-dip galvanized malleable iron, and is available with or without aluminum or copper liners. It will accommodate up to 0.85-in. maximum cable seat diameter.

To remove the keeper, lineman loosens nuts from U-bolts, inserts a hot stick into the eye, and lifts keeper off the clamp. Reassembly is quickly accomplished by reversing the process.

Porcelain Insulator Corp, Dept 85, Lima, N. Y.

(*More New Equipment on page* 94)

ON THE LINE...

New Hubbard Faultmaster Keeps Pace With Growing Systems!

HUBBARD
Small bore single vent tube provides high pressure positive expulsion. Fibreglass reinforcing assures long tube life.

Proper application of fuse cutouts is greatly simplified by the use of the new Hubbard Faultmaster. The design leads the industry with a new single vent, small bore, fibreglass-reinforced fuse tube. Flippers, flying caps, tricky vents and other remedial accessories are not required. Without "blind spots," the Faultmaster is able to clear faults from a few amperes through its maximum rating. Future obsolescence can be avoided now, for the great flexibility of the Faultmaster provides superior protection for today's system and, without extra cost, has the built-in-reserve for operation on the system of tomorrow.

Unique, high strength recoil members and husky fasteners absorb, minimize and distribute the stresses of high fault interruption over the sturdy, solid porcelain column. The entire current path is silver plated and current transfer points are under spring pressure. Springs are made from non-aging materials and designed to operate well below their elastic limit to insure positive contact pressure throughout the useful life of the cutout. All working parts are of corrosion free non-ferrous materials. Get the full story today from your Hubbard distributor or write for a copy of Bulletin P-756.

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago, Ill.
Oakland, Calif.
Plano (Dallas), Texas

Uptegraff

New Design of 167 KVA
Smaller . . . Lighter

Reduced Size . . . Reduced Weight		
	Old 167 kva Spec. 3610-G	New 167 kva Spec. 3742-A
Height	53¼	46½
Width	36¾	31¾
Depth	40⅝	33⅜
Total Weight	2300	1600

Quality Control

insures top performance of POLE TYPE DISTRIBUTION TRANSFORMERS

Good workmanship—combined with superior design and the best materials—is vitally important in producing quality transformers. For more than 30 years Uptegraff has emphasized persistent quality control throughout all of its manufacturing processes.

One example is the Uptegraff pole type distribution transformer—the photo shows the size of the newly-designed 167 kva compared to the old model 100 kva. This advanced modern design provides considerable economies because of the reduced size and weight.

Moreover, every step in the manufacture of these new models—as in all Uptegraff transformers—is carefully controlled by experienced department supervisors *from coil winding to final assembly*. Constant testing and inspection of core and coil assemblies and sub-assemblies are part of the Uptegraff quality control. The result is transformers which insure longer life and lower maintenance as well as top performance.

R. E. Uptegraff Manufacturing Co.
Scottdale, Pennsylvania

RATIO AND POLARITY TESTS are applied to each core and coil sub-assembly, as seen in the use of the above production line testing consoles

CORE TESTING, after annealing and before subsequent processing, to insure against high core loss and exciting current.

INET

BATTERY CHARGERS

GUARANTEE UNFAILING RELIABILITY

You get built-in reliability guaranteed to give trouble-free performance year after year. Magnetic amplifier controlled with absolutely no tubes, no wearing or moving parts. Just plug it in and forget it. Completely automatic.

There's a custom-built Inet Regulated Battery Charger for every requirement. Write for Bulletin, *Battery Chargers.*

BATTERY CHARGERS LEACH CORPORATION/INET DIVISION

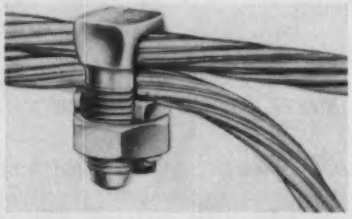
4441 So. Santa Fe Ave., Los Angeles 58, California

District Offices and Representatives in Principal Cities of U. S. and Canada

Distribution Transformers...

. . . in lower rating are additions to line of small, light dry-type units. Model DT-3 for 3-phase operation is extended to include ratings down to 30 kva in either 600 or 2,400-v class. Unit is 22% smaller, 20% lighter than its predecessor. Model DS-3, a single-phase transformer, includes a 15-kva unit in 600 and 5,000-v class, with reductions of 15% in size and 20% in weight. Construction features mechanically isolated cores and coils to provide low sound levels. Largest 3-phase model is 300 kva; largest single phase, 167 kva.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.



Split-Bolt Connectors . . .

. . . cold forged of copper in the more popular sizes fit No. 10 solid through 1/0 stranded copper conductors.

Designed for tight connections under all temperatures and conductor-load variations, these 99%-copper clamps contract and expand with the copper conductor to keep a continuous tight connection and prevent cold flow and nicking of the conductor.

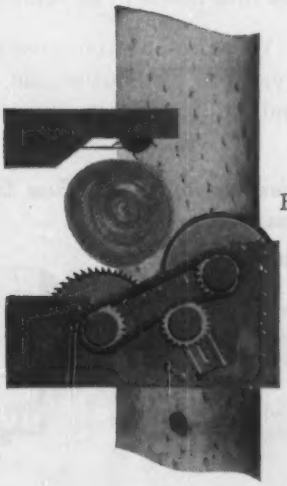
A. B. Chance Co, Centralia, Mo.

All-Aluminum Cable . . .

. . . for overhead lines weighs less than ACSR, is stronger than EC. Cost per 1,000 ft is no more than that of equivalent sizes of 6/1 ACSR. Sag of 5005 conductor is less than EC cables for all loadings, span lengths, temperatures, and sizes. In urban span lengths, sag at 60F compares favorably with conductors of other metals.

(*Continued on page* 98)

"No, Babe, them ain't woodpecker holes!" Paul Bunyan and his Blue Ox were admiring a BAXCO Douglas Fir pole just off the shaving-incising machine. Paul carefully lifted a shed off its foundations to reveal the operation. "See that there wheel with all the teeth, Babe? Well, she's another invention of them Baxter folks — called an incisor.* While the pole gits shaved it also gits nicked its entire length by these teeth so as the presarvatives can git a good holt in the wood." Paul giggled. "Works kinda like a bum barber, don't it?"



BAXCO® DOUGLAS FIR POLES / FULL LENGTH MACHINE INCISED
(pressure treated)

*Yes, Paul, if you're a fir pole it DOES pay to "git nicked" while getting shaved. Because those "nicks," or small incisions made by the teeth of the incisor over the full length of the shaved wood surface assure a more uniform distribution of the preservative forced deep into the wood by pressure treatment. End result: longer pole life.

Furthermore, this incising operation (U.S. patent No. 2,781,802) tends to minimize checking. So for longer lasting, better looking poles specify BAXCO Douglas Fir Poles, always incised, always machine shaved, and always pressure treated.

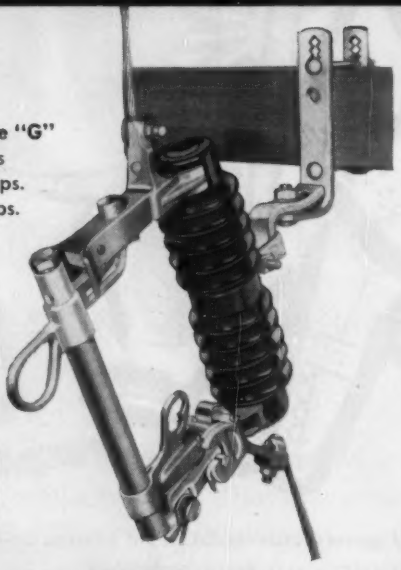
Pressure treatments available: Creosote, Chemonite, Pentachlorophenol, in accordance with Federal and AWPA specifications.

© J. H. Baxter & Co. 1957

J. H. BAXTER & CO. *120 Montgomery Street, San Francisco 4, California*

KEARNEY *double venting*

Type "G" TRIPOUT



HEAVY DUTY Type "G"
with NEMA hangers
7.8 kv.—5,000 amps.
15 kv.—4,000 amps.

EXTRA HEAVY DUTY
Type "G" high strength channel hangers with shock-absorbing neoprene washer between hanger and band 7.8 kv.—10,000 amps. 15 kv.—8,000 amps.

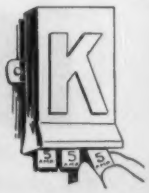
The KEARNEY Type "G" Tripout's double venting action accurately clears high current faults every time without damage. Low current faults are interrupted with equal reliability.

Top vent directs expulsion gasses harmlessly away from other live equipment. Cartridge recoil from top gas jet keeps upper contacts closed during arc interruption. Patented, full-floating top contact eliminates contact burning, maintains high contact pressure until arc is extinguished and cartridge drops out. Never needs adjusting . . . weather-protected by cast bronze hood. The Type "G," fused with standard buttonhead links, will clear the full range of overload and fault currents without the use of special gadgets. To restore the Type "G" to service, only the fuse link needs to be replaced.

Let your KEARNEY Representative give you full details on the Type "G" Tripout engineered to meet your load and fault conditions *precisely*.

Top quality cutouts deserve top quality Fuse Links . . . and KEARNEY has them for you!

KEARNEY's broad line of fuse links meets a greater variety of conditions. Precision-engineered, with matched time-current characteristics... for easy, accurate coordination to meet the specific requirements of your distribution circuits. Patented KEARNEY Pull-Tab Fuse-Pak for selecting right fuse quickly.



for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

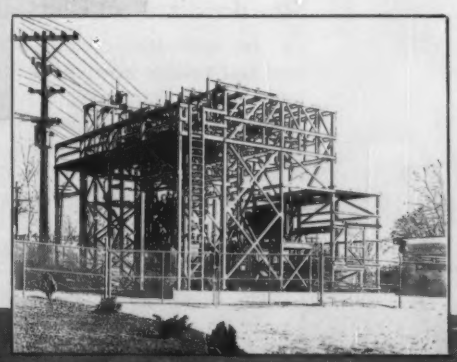
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

The Mark of Quality

KEARNEY PRODUCTS

Plants at ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA — GUELPH, ONTARIO, CANADA

action assures positive protection without the use of gadgets



-371

CUTOUTS AND FUSE LINKS FIELD-TESTED

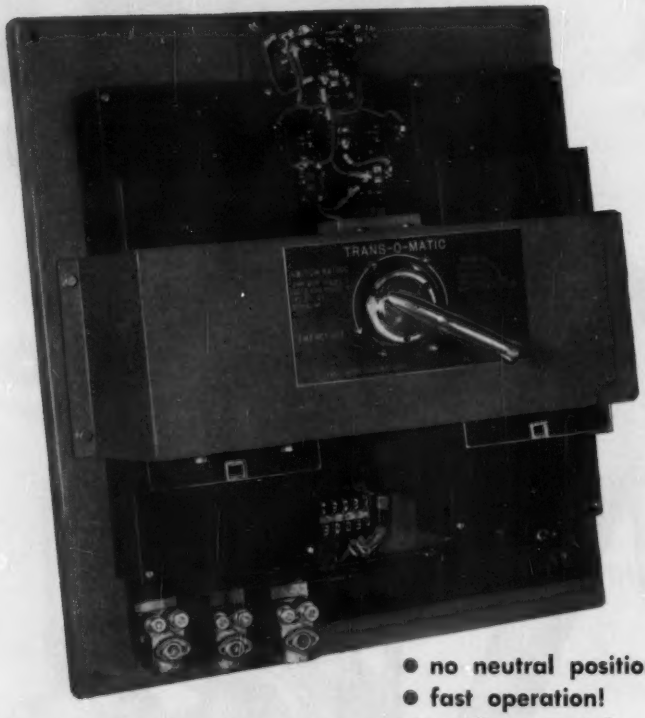
Here at KEARNEY's Substation Laboratory of 150,000 KVA Transformer Capacity—with a back up power of 445,000 KVA—all equipment is tested under rigorous field conditions. KEARNEY Certified Ratings are proved performance ratings . . . not just theoretical calculations. You can be sure they'll do the job . . . with a generous margin of safety.

JAMES R. KEARNEY CORPORATION

General Offices: 4224-42 Clayton Ave. • St. Louis 10, Mo.

Plants at: ST. LOUIS • FAYETTEVILLE, ARK.
SHENANDOAH & CLARINDA, IA.
GUELPH, ONT., CAN.

TRANS-O-MATIC WORKS



- no neutral position!
- fast operation!
- total or partial failure protection!

This failure-proof transfer switch employs two mechanically-linked molded case circuit breakers for positive transfer to emergency source. Full relay protection on transfer, with power taken from side to which the load is transferred. Available in sizes to 600 volts, 800 amps, and 50,000 amp interrupting capacity.

Request Trans-o-matic Automatic Transfer Switch Bulletin TS-56 for details.

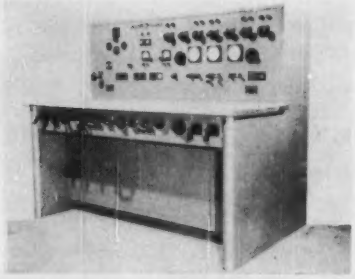
LAKE SHORE
Electric CORPORATION
207 WILLIS AVENUE
BEDFORD, OHIO

All Aluminum Cable

(*Continued from page* 94)

Diameter of Wire (inches)	Tensile Strength		Min Elongation, in 10 in.
	Min.	Lot Average	
0.0701–0.0800	36,500	37,500	1.4
0.0801–0.0900	36,000	37,000	1.5
0.0901–0.1000	35,500	36,500	1.5
0.1001–0.1100	35,000	36,000	1.5
0.1101–0.1200	34,500	35,500	1.6
0.1201–0.1400	34,500	35,500	1.7
0.1401–0.1500	33,500	34,500	1.8
0.1501–0.1600	33,000	34,000	1.9
0.1601–0.2100	31,000	32,000	2.0

Seven-strand cable has same conductance as comparable 6/1 ACSR. Current carrying capacities are greater than for EC, ACSR, and cables of other metals having same d-c resistance. Cable dissipates heat quickly. Splices and dead-ends are easily made, making it suitable for urban service area. It is also useful for service in contaminated areas. **Reynolds Metals Co, 2500 S. Third St, Louisville, Ky**



Standardization Console...

. . . for calibrating a-c and d-c current and voltage instruments can be operated by non-skilled workers. Galvanometers, ammeters, oscillographs, frequency meters, voltmeters, and wattmeters, can be calibrated in minutes. D-c measurements are accurate to 0.01, a-c to 0.05%, depending on reference used. Instrument ranges from microvolts and microamps to 150 amp, 750 v can be accommodated.

A-c/d-c switching permits use of "transfer standards" method of standardizing to obtain wide range and high accuracy. With power supply, control circuitry, and all

(*Continued on page* 100)

world's smallest, lightest indoor/outdoor unit: only nine pounds . . . completely weather resistant

Designed for indoor/outdoor use, the new Westinghouse Type EMP potential transformer resists the effects of weather, as well as the industrial hazards of acids and alkali fumes. This makes it the ideal companion to use with the molded Types EMO and EMR current transformers.

The Type EMP has a thermal capacity of 150 VA and an accuracy of 0.3 at W burden. It will operate with 0.3 accuracy on practically all single meter installations and will handle multimeter installations with the same accuracy, providing the overall burden does not exceed 12.5 VA at 10% P.F.

The Type EMP is the FIRST completely molded potential transformer. Its unique construction results in such outstanding performance features as:

Longer life — Utilizing a polyester elastomer insulating material — a product of Westinghouse research — combined with corrosion-resistant metalware (baseplate and terminal studs) makes the EMP ideal for indoor/outdoor use. This resilient plastic covering is virtually shatter and chip-proof.

Lighter, Smaller. Polyester molding results in a smaller unit, with a total weight of only nine pounds.

Unequaled dielectric stability. The polyester insulating material will not break down even under severe dielectric stresses. The EMP has an impulse test level of 10-kv.

The new Type EMP potential transformer is available in 240-120, 480-120 and 600-120 volt ratings. For further information, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-70824

YOU CAN BE SURE...IF IT'S

Westinghouse

CUT

POWER DISTRIBUTION COSTS WITH THIS VERSATILE CABLE

Triangle Type RR Cable is rubber insulated and neoprene jacketed. Three top-grade rubber insulations are available to match the service requirements. The jacket is Triangle's Trioprene, a neoprene compound developed especially for its toughness and resilience, its good aging and heat resisting properties, plus its ability to withstand severe weather conditions, oil, grease, and most chemicals.

Flexible, light weight and tough, it is easier to handle, splice, or terminate than metallic sheathed cable, has lower first cost. And, its suitability for overhead, or underground, or duct installations makes it unnecessary to carry more than this one type in inventory. Approved for Airport Lighting Cable Type A (CAA L-824) and for Underground Service Entrance, Underwriters' Laboratories Type USE.

TRIANGLE CONDUIT & CABLE CO., INC., New Brunswick, N. J.

Write for Bulletin RR

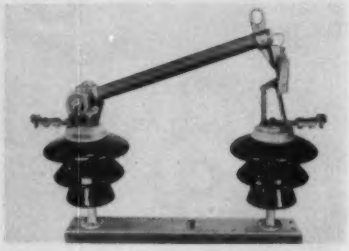
Buy Smart — Buy from Your Distributor!

TRIANGLE
It MUST Be Right!

Standardization Console

(*Continued from page* 98)

necessary accessories, console measures 6 ft long by 4 ft wide, and 5 ft high. Bulletin GEA-6682 provides complete information.
General Electric Co, Schenectady 5, N. Y.



Disconnect Switches . . .

. . . with fiber glass fuse tubes have high interrupting capacities. Fuse tubes rated 46 kv and above have shielding to prevent fuse link damage from corona. Type FHB-1 is available in ratings from 7.5 to 69 kv, with current capacities from 50 to 200 amp; Type FMH-1, ratings of 69 to 115 kv, with capacities up to 200 and 300 amp; Type FHMH-1 is rated 400 amp at 69 kv, 200 amp at 115 and 161 kv.
Southern States Equipment Corp, Hampton, Ga.

Magnet Wire . . .

. . . has polyester film coating for heat-resistance up to 155C. Called Anatherm, it is made for motors, transformers, and electronic equipment. It features high abrasion resistance, dielectric strength, and chemical resistance. Single and heavy film thickness in AWG sizes from 15 through 25 are available.
Anaconda Wire & Cable Co, Muskegon, Mich.

Programming Machine . . .

. . . and automatic tape punch for business application can be used for inventory control, accounts payable,

(*Continued on page* 101)

Programming Machine

(*Continued from page* 100)

expense distribution, labor distribution, or integrated order billing. The programming machine converts calculator results to punched tape which can be fed to tape-to-card converter for subsequent use on data processing machines or to teletype for automatic transmission to other offices. It uses 5, 6, 7, or 8-channel paper tape. Up to 102 steps may be used for each read-out sequence.

Comptometer Corp, 1735 N. Paulina St, Chicago, Ill.

More New Products

Low-cost 3-pole QO **circuit breaker load centers** for residential and light commercial work use a split main bus which eliminates need for a central main disconnect. Load centers are available for from 12 to 42 circuits.—Square D Co, 6060 Rivard St, Detroit 11, Mich.

Hanger condulet for lighting fixtures is supported by conduit straps. This permits several to be connected on the floor, then raised as a unit.—Crouse Hinds Co, Wolf & Seventh North Sts, Syracuse 1, N. Y.

Translucent vinyl plastic **protective fabric** with Fortisan 36 mesh can be used to keep working areas free of dust and contaminants. Called F 36 clear, the light weight fabric is easily set up or taken down, requires little storage space.—Herculite Protective Fabrics, 140 Little St, Belleville, N. J.

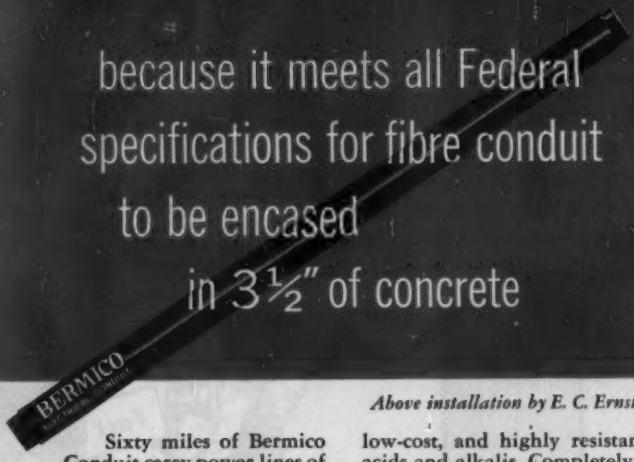
Fused trolley tap takes all regular trolley tap fuses and fits all popular cable sizes. It is fire resistant, makes positive electrical connection, and stops cable and insert pull-outs.—Standard Devices Co, 3231 Warrensville Center Rd, Cleveland 22, Ohio

Panel meters, contact meter-relays, and pyrometers with **6-v illumination** are offered in 4½ in. rectangular cases. Life of screw-in lamp is 350 hrs at full voltage.—Assembly Products, Inc, Chesterland, Ohio.

BUY
ALL TRIANGLE PRODUCTS LOCALLY FROM YOUR ELECTRICAL DISTRIBUTOR
It's smart today to buy all your electrical needs — switches, fittings, wire, conduit, cable — from your nearby distributor. One call shopping saves you time and money.
Your distributor's warehousing saves you countless cubic feet of valuable floor space, and assures you of a constant flow of fresh materials as your production demands.
Your distributor gives you
Fast delivery . . . on one item or a hundred— from one manufacturer, or from many.
Simplified bookkeeping . . . one invoice, one statement, one account.
Low inventory cost . . . his stock is your inventory control, gives you working capital.
Lower insurance rates . . . less inventory means your flood, fire rates are lessened.
That's why dependable electrical manufacturers advise you to always buy from YOUR DISTRIBUTOR — THE BEST FRIEND YOUR BUSINESS CAN HAVE! He's the one source for everything electrical — and he's local.
TRIANGLE CONDUIT & CABLE CO., INC., New Brunswick, N. J.
Your Distributor— The Best Friend Your Business Can Have!
Buy Smart — Buy from Your Distributor!
TRIANGLE
It MUST Be Right!
Lower Insurance Rates
Fast Delivery
Low Inventory Cost
Simplified Bookkeeping
TRIANGLE CABLE

BERMICO® electrical conduit used at Norfolk Naval Air Station...

because it meets all Federal specifications for fibre conduit to be encased in 3½" of concrete



Above installation by E. C. Ernst, Inc.

Sixty miles of Bermico Conduit carry power lines of up to 34,000 volts as well as signal lines for communications and supervisory systems at the U.S. Naval Air Station, Norfolk, Va.

Precision engineered Bermico Conduit is made to exacting specifications from cellulose impregnated with pitch. It is strong, light, low-cost, and highly resistant to acids and alkalis. Completely uniform, it installs quickly and easily.

Bermico Conduit is specified by leading electrical contractors and by public utilities from coast to coast. To speed your cable installations . . . specify Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electrical Supply Company

Offices in principal cities

BROWN COMPANY

Berlin, New Hampshire

CATALOGS–BULLETINS

• **DRY AND DIRECT BURIAL TRANSFORMERS:** Offered by ESCO Mfg Co are two catalogs describing its transformers. One covers dry type transformers and unit substations while the other deals with underground transformers. Write the company at P. O. Box 1039, Greenville, Texas.

• **CU-NI ALLOY:** "Cold" resistor usage are among the applications of this Copel alloy where mechanical stability and low coefficient of resistance are required. Specifications are given in a catalog printed by Hoskins Mfg Co, 4445 Lawton Ave, Detroit 8, Mich.

• **PHOTOELECTRIC CONTROL:** "Cats Eye" slit optical system is described and component data for a photoelectric system are given in a bulletin issued by Mason Instrument Co, 29 Elm Ave, Mt Vernon, N. Y.

• **SURFACE CONDENSERS:** Delta Vee design condensers are illustrated in Southwestern Engineering Co's bulletin M-571. Design and technical data can be obtained by writing to the company 4800 Santa Fe Ave, Los Angeles 58, Calif.

• **AL CONDUCTOR NAMES:** Large reference wall chart contains all aluminum electrical conductors code name designations. "Electrical Conductor Code Names" is distributed by Kaiser Aluminum & Chemical Sales, Inc, 919 N. Michigan Ave, Chicago 11, Ill.

• **DISPLAY LIGHTING:** An eight page folder, No. 300-21, shows Fluoresign Outdoor Luminaire produced by Revere Electric Mfg Co, 6009 Broadway, Chicago 40, Ill.

• **MOTOR CARE:** A Guide to Care of Electric Motors, 16 pages, is available from Chicago Electric Co, 1318 W. Cermak Rd, Chicago 8, Ill.

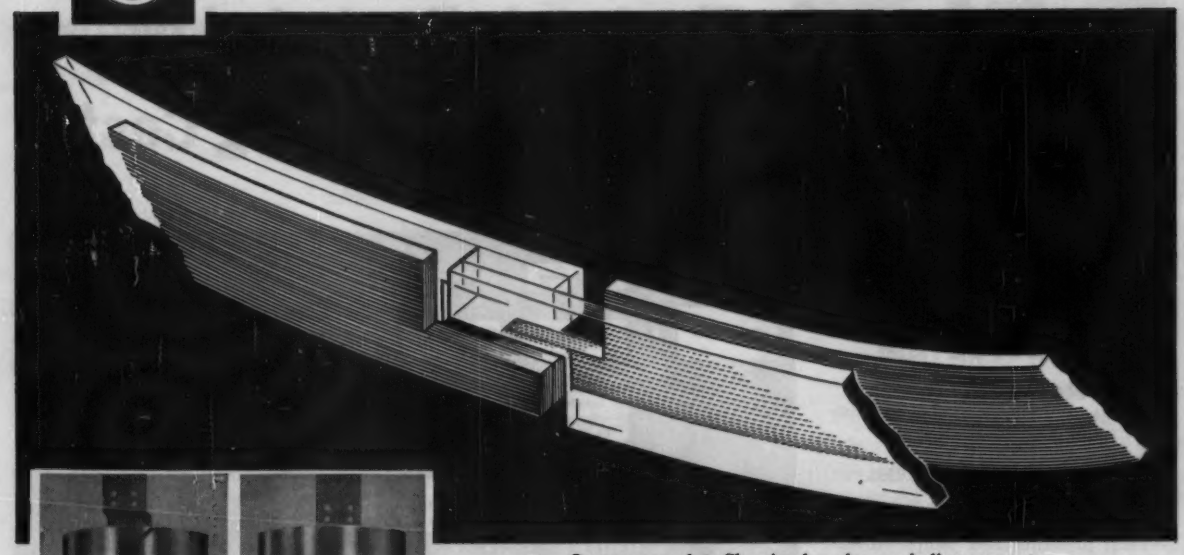
• **CONTROL AND LIGHTING CABLES:** Two bulletins recently issued by Ansonia Wire & Cable Co, Ashton, R. I. cover supervisory control, station control street lighting, and series lighting cables.

• **BLOWERS AND PUMPS:** Bulletin S-59F contains lines of Stutorbilt blowers, gas pumps, and vacuum pumps. Copies are published by Stutorbilt Corp, Maywood, Calif.

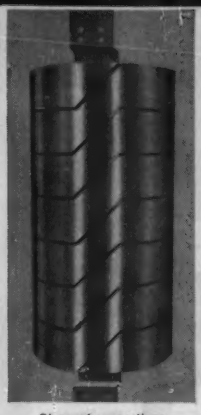
• **HIGH VOLTAGE RESISTORS:** Available from International Resistance Co is their bulletin G-1b which includes comprehensive data on its high voltage resistors. Write the company, 401 N. Broad Street, Philadelphia 8, Pa.

• **LIGHTED SWITCHES:** Data sheet 128 describes its line of magnetic hold-in lighted pushbutton switches. It is available from Micro Switch Division, Minneapolis-Honeywell Regulator Co, Freeport, Ill.

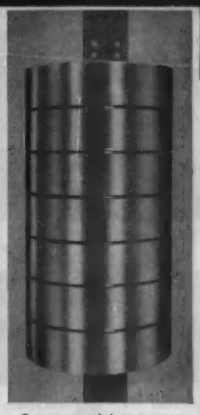
UNIT SUBSTATION TRANSFORMERS



Crossover point. Showing how inner winding connects with outer winding at center of transformer secondary.

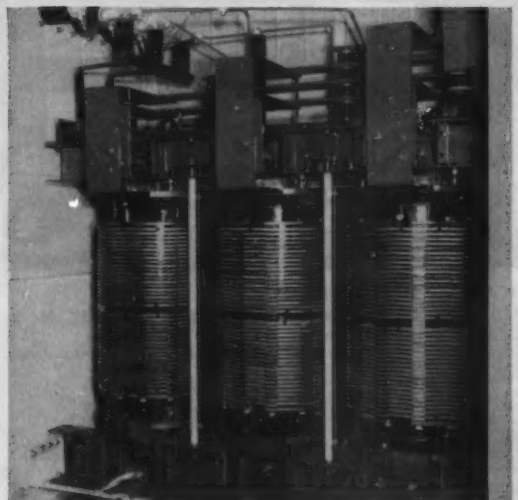


Diagonal connections between rings.



Crossover point on reverse side of transformer.

BRUTE STRENGTH SECONDARIES WOUND FROM SOLID BUS— NO MECHANICAL JOINTS



Completed dry-type transformer mounted in ventilated housing.

From one end of the secondary to the other in these I-T-E unit substation transformers, electricity flows through solid copper bus bar.

This is a unique design for high current secondary windings embodying great structural strength, plus low reactance and high conductivity. Lengths of copper bus, cut on a diagonal and formed into rings, are brazed together below the diagonal gap in such a manner as to form a continuous electrical winding.

Where greater current carrying capacity is required, two such windings are paralleled, but a crossover at the midpoint causes each of the parallel paths to have half its turns in the outer layer and half in the inner—equalizing the impedance of the two parallel paths and distributing the reactance evenly.

Write for complete information. I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

Transformer & Rectifier Division

Control section of Kellogg's electronic computer.

Electronic Route to Lower Steam Power Piping Costs

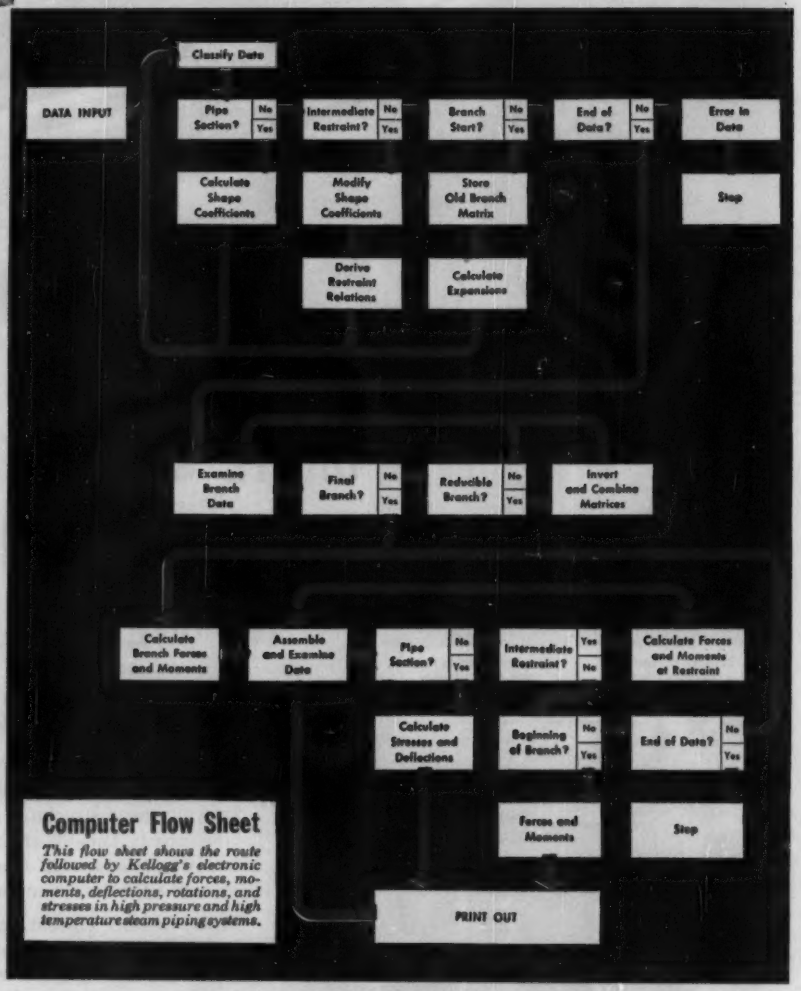
Kellogg's Digital Computer Permits More and Faster Accurate Flexibility Analysis of Complex Main and Reheat Piping Systems

KEEPING PACE with the increasingly critical pressures and temperatures of the modern steam-electric power plant are M. W. Kellogg's advanced techniques for pre-determining stresses and reactions of main and reheat piping. Most recent addition is a large magnetic drum digital computer, used to calculate forces, moments, deflections, rotations, and stresses in complex piping systems.

By enabling Kellogg engineers to undertake a far greater number of calculations in less time than ever before, electronic computation makes possible the ultimate or near ultimate piping system designs. Pipe runs can often be shortened without sacrificing required margins of safety; capital investment and maintenance costs reduced; operating efficiency increased.

A pioneer in flexibility analysis techniques, which include manual calculations, model testing, and a smaller electronic computer, Kellogg continues its pioneering in the power piping industry by the addition of this high speed computer to its New York engineering facilities.

A cordial invitation to see the M. W. Kellogg electronic computer at work is extended to consulting engineers and to engineers of power generating companies and their equipment manufacturers. Appointments may be made through the Sales Manager, Fabricated Products Division.



Computer Flow Sheet

This flow sheet shows the route followed by Kellogg's electronic computer to calculate forces, moments, deflections, rotations, and stresses in high pressure and high temperature steam piping systems.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.
A SUBSIDIARY OF PULLMAN INCORPORATED
The Canadian Kellogg Company Limited, Toronto • Kellogg International Corporation, London • Societe Kellogg, Paris
Kellogg Pan American Corporation, New York • Companhia Kellogg Brasileira, Rio de Janeiro
Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK

ELECTRICAL BUSINESS OUTLOOK

Electrical World
SEPTEMBER 9, 1957

Rising freight rates will make oil look more attractive as a fuel for power production in many parts of the country, since they affect coal delivery costs more than oil costs. A higher percentage of coal is shipped by rail, much oil being trucked or piped.

And you can see a trend toward increased use of oil in the Federal Power Commission's figures on electric utility fuel consumption for the first half of 1957. While burning 2.8% more coal during the half, utilities used 6.7% more oil.

The figures for June are more impressive: Coal up 1.3% over last June; oil up 35.7% to 6.2 million barrels.

• • •

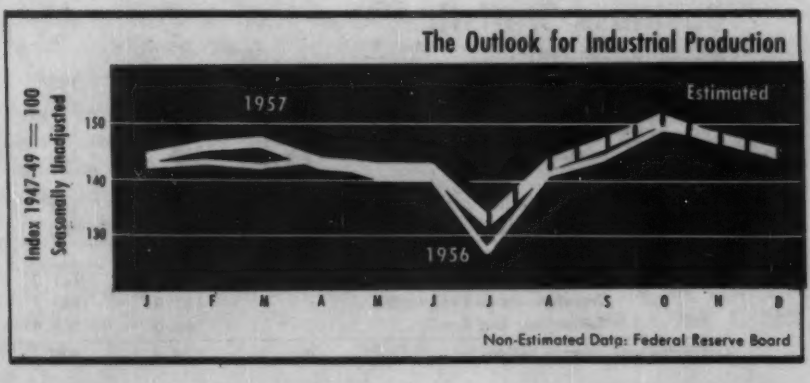
The time to buy copper may be near at hand, says United Business Service. Although fabricators' sales for July were the lowest since 1949, and prices continued to drop all through August, the Service urges consideration of these points: 1. Output is down and may go down further. 2. Production costs of copper are still rising. 3. Hidden inventories are pretty well used up. 4. Demand always turns up in the fall. Therefore, concludes UBS, it might be worth while for heavy users to replenish their copper inventories soon.

• • •

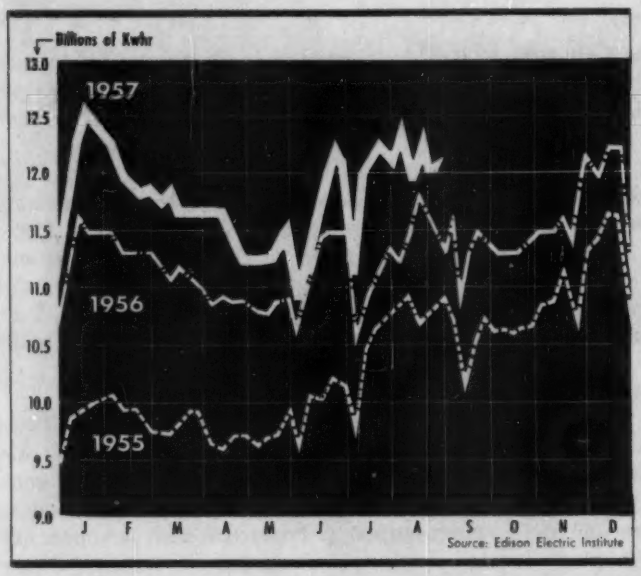
Industry will spend about $7.3 billion on research and development this year, according to McGraw-Hill's Department of Economics. That represents a jump of 20% over last year's figure—and is almost double what was spent in 1953.

The full impact of the boom in research won't show up for several years. But already there's been an increase in the number of companies who are building new plants and equipment to produce new products. Last year 28% of all manufacturing companies were making significant capital expenditures for this purpose. This year the percentage is up to 32% with makers of electrical equipment leading the pack—65% of them.

Manufacturers now estimate that at least 10% of their 1960 sales will be in new products not on the market in '56. And for the industries who are doing most of today's research, the figure is much higher. The chemical industry expects 16% of its 1960 sales in new products, electrical machinery 18%, and the aircraft industry almost 40%.



STATISTICS



OUTPUT

Week ended August 31,
12,147,000,000 Kwhr
Up 5.0%

Per Cent Change From Previous Year

	Aug. 17	Aug. 24	Aug. 31
Total U. S.	+ 5.2	+ 6.0	+ 5.0
New Eng.	+ 1.2	+ 2.6	+ 3.6
Mid. Atlan.	− 0.9	+ 1.3	− 1.4
Cent. Ind.	+ 3.9	+ 4.9	+ 2.8
West Cent.	+10.3	+ 7.0	+ 6.1
Southeast	+ 6.3	+ 4.8	+ 5.5
South Cent.	+ 7.2	+16.0	+16.6
Rocky Mount.	+ 6.3	+ 6.3	+ 2.8
Pacific			
NW	+ 8.9	+ 8.6	+ 9.4
SW	+10.5	+ 9.4	+ 7.9

Seasonally Adjusted Index 229.1
Week Ago 227.0
Year Ago 218.3

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 5.9%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	June	124.43	122.79	117.50	5.9
Peak—Class 1 Systems, million kw	May	97.8	97.7	92.8	5.4
Estimated Dec. '57 Peak	May	113.6	113.8	114.3	−0.6
Production—billion kwhr	June	52.05	51.70	49.45	5.3
Hydro		11.18	11.80	10.05	11.2
Fuel		40.87	39.90	39.40	3.7
Sales—billion kwhr	May	46.60	47.15	44.18	5.5
Residential		11.86	12.72	11.07	7.1
Commercial		7.38	7.25	6.75	9.3
Industrial		24.89	24.66	24.03	3.6
Other		2.48	2.52	2.33	6.4
Fuel Consumption	June				
Coal—million tons		12.50	12.60	12.34	1.3
Oil—million barrels		6.24	6.31	4.61	35.4
Gas—billion cu ft		125.72	108.66	127.04	−1.0
Net Income Class A & B Co's—$ million	June	109.69	101.75	101.54	8.0
Residential Customers—millions	12 mos.	46.16	46.06	44.86	2.9
Revenue per kwhr	ended	2.58¢	2.58¢	2.62¢	−1.5
Avg kwhr per customer	May 31	3,047	3,034	2,858	6.6
Avg annual bill		$78.61	$78.28	$74.88	5.0

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	July	135	145	128	5.5
ENR Construction Cost	Aug	154.8	151.8	146.0	6.0
BLS Cost-of-living	July	120.8	120.2	117.0	3.2
New Orders for Machinery (1950 = 100)	July	146	153	146	n.c.
NEMA Sales					
Insulation materials	June	140	148	156	−10.3
Electric appliances		93	88	106	−12.3
Wholesale prices	June				
Motors and generators		141.0	141.3	132.3	6.6
Transformers and regulators		147.8	147.7	138.2	6.9
Switchgear and fuses		166.0	165.9	152.3	9.0
GNP—annual rate—$ billion	2nd qtr.	434.4	429.1	410.8	5.7

MANAGEMENT BULLETIN

FINANCE

Two recent electric utility bond issues with "Aa" ratings went fairly well. One issue, $40 million of Southern California Edison Co first mtg 4⅞% bonds offered to the public at a yield of 4.80%, are now all sold. The other issue, $60 million first mtg 4⅞% bonds Public Service Electric & Gas Co offered to yield 4.81% went "fairly well" with some bonds still available.

Utility cancels plan to sell bonds competitively. Public Service Co of Indiana asks for PSC approval to sell $35 million of first mtg 4⅞% bonds to a group of institutional investors rather than sell them competitively. Originally the company planned a public sale of the bonds in October, 1956 but later postponed the date to Oct. 9, 1957.

Mutual fund makes changes in its electric utility investments. Affiliated Fund makes new common stock purchases in Cleveland Electric Illuminating Co and Kentucky Utilities Co. It sold out these holdings: Central Hudson Gas & Electric Co, Idaho Power Co, Indianapolis Power & Light Co, and Potomac Electric Power Co.

Electric utilities continue to increase their quarterly common stock dividends. Maine Public Service Co is upping its dividend by 1¢ a share to 28¢ . . . Middle South Utilities boosts its dividend to 42½¢ a share as compared with 40¢ in the previous quarter.

Utility commons vs fixed income securities. A Goldman, Sachs & Co study "Investment Comment" says that because of the high yields now available on bonds some investors are raising the question of whether to buy or hold public utility common stocks.

The spread in yields, the study points out, "in favor of utility common stocks as compared to outstanding high grade utility preferred stocks, medium grade preferred stocks, and utility bonds as represented by Moody's averages is either non-existent or abnormally low."

Moody's utility common stock yields in the last ten years, the study says, have roughly averaged 100 basis points higher than medium grade preferreds, 150 basis points above high grade preferreds, and around 250 basis points above the utility bond average. Thus, on a long term comparison of yields alone, investors may well question utility common stocks at this time.

The utility industry, the survey says, is still facing inflationary problems together with high interest costs. These problems can be met as they were in the past. Utility companies will seek rate increases. They will also make every effort to improve their operating ratios. The survey concludes with this statement: "We do not suggest switching utility common stocks into fixed-income securities for we believe that over a period of time utility companies will report further improvement in earnings and increased common stock dividends."

If you would like a copy of this study, write Cecil E. Trefthen, utility security analyst, Goldman, Sachs & Co, 20 Broad St, New York 5.

RATES

Another rate increase granted. Niagara Mohawk Power Corp gets $8,225,000 a year rate hike, effective August 31. This is $1.7 million less than the estimated increase in the rates originally filed by the company, reports the PSC. So far this year, seven companies have received a total of over $12.1 million a year in rate hikes.

Average monthly bills for residential service in U. S. up slightly. The bill for 250 kwhr per month increased 2¢, moving from $7.21 on Jan. 1, 1956 to $7.23 on Jan. 1, 1957. The bill for 100 kwhr was $3.89 on Jan. 1, 1957, up 1¢ from the preceding year, Federal Power Commission reports.

REGULATIONS

Mississippi PSC adopts its first rules on practice and procedure. In one rule it has decided a manufacturer's preference is a strong factor in determining whether his plant would be served by a private utility or co-op. Private utilities have supported this decision, while the co-ops said public utilities should serve industry in rural areas.

A private utility will also be permitted to request an additional certificate of necessity to operate in an area already served by a co-op but taken in by expansion of municipal boundaries. Private utilities wanted the certificate to expand within the boundaries automatically and the co-ops wanted the utilities kept out.

DEPRECIATION

Utilities should press for equitable treatment of liberalized depreciation. Recent news indicates Uncle Sam is soon likely to clamp down on issuing any further Certificates of Necessity granting accelerated amortization for defense projects.

Some utilities have refrained from claiming liberalized depreciation on property additions made since Jan. 1, 1954 because of uncertainty as to how regulatory commissions would treat the tax deferral for rate-making purposes.

Anticipated termination of accelerated amortization points up the advisability of such utilities claiming liberalized depreciation on all facilities built since 1954 including the uncertified portion of facilities as to which they hold Certificates of Necessity.

The record of regulatory decisions in respect to rate-making procedures involving liberalized depreciation on the whole has been an adverse one. Rulings, requiring the use of actual taxes, have numbered five, those permitting normalized taxes for rate-making purposes have been two. In spite of this, management should present such persuasive evidence to all commissions and courts including those that have ruled adversely that the use of liberalized depreciation and the concurrent normalization of the tax deferral will benefit both the customers and the utilities.

EMPLOYEE RELATIONS

Chances are your employees will never receive a 100% efficiency rating—you wouldn't want trained robots anyway.

But there's no arguing that effective employees are desirable. They are a key factor in a company's success and progress. They indirectly lower production costs. And they are a company's best advertisement.

The importance of this has been recognized by Edison Electric Institute's Industrial Relations Committee, which will explore methods of "Enlarging Employee Effectiveness" at its 10th Annual Round Table Conference, September 23-25, in Chicago.

Experts will be on hand to lead discussions on such problems as utilizing the work force, employee training and development, effective intra-company communications to increase understanding and cooperation, and methods of developing morale and loyalty. For more information, write Ed Evans, Secretary, Industrial Relations Committee, EEI, 420 Lexington Ave., N. Y. C.

Curriculum workshop in electrical engineering education is now being held. Representatives of 100 American colleges are now meeting at Massachusetts Institute of Technology at Cambridge to plan for educating the next generation of electrical engineering students to play a creative role in and to lead professional advancement in the work of tomorrow. New developments in science, equipment, and techniques challenge former specialization of students in narrow areas.

A. B. CHANCE CO.

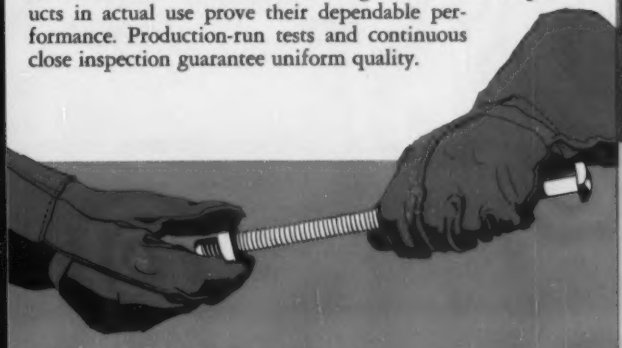
POLE LINE HARDWARE

FIELD ENGINEERED TO MEET TODAY'S CONSTRUCTION NEEDS

Continuous field research by Chance Engineers in the development of anchors, guying materials, protective devices and switchgear is now being applied to Pole Line Hardware, newest addition to Chance's product lines. Out in the field, Chance Engineers get first-hand knowledge of modern line construction needs. Combining this knowledge with laboratory development and product testing techniques, Chance is able to offer improved products specifically designed to meet your pole line hardware requirements.

QUALITY CONTROLLED TO MEET OR EXCEED ALL INDUSTRY SPECIFICATIONS

A plant-wide checking and inspection system controls the quality of all Chance Pole Line Hardware. Products are subjected to much more severe conditions in laboratory tests than would be encountered in the field, so that adequate safety factors can be built into Chance designs. Field tests of products in actual use prove their dependable performance. Production-run tests and continuous close inspection guarantee uniform quality.



"...and you can get CHANCE HARDWARE locally—from your line equipment wholesaler"

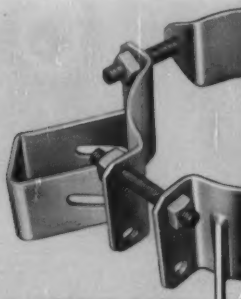
JACK CURTRIGHT,
Sales Manager,
Wholesaler Products,
A. B. Chance Company

Serving the Utility Industries since 1907

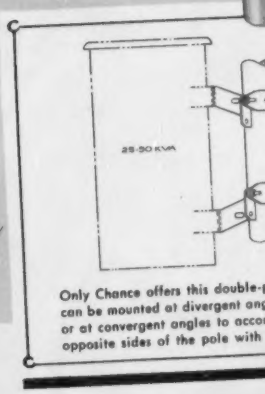
50 YEARS
ANNIVERSARY
A. B. CHANCE COMPANY

FIELD ENGINEERED TO MEET TODAY'S CONSTRUCTION NEEDS

Continuous field research by Chance Engineers in the development of anchors, guying materials, protective devices and switchgear is now being applied to Pole Line Hardware, newest addition to Chance's product lines. Out in the field, Chance Engineers get first-hand knowledge of modern line construction needs. Combining this knowledge with laboratory development and product testing techniques, Chance is able to offer improved products specifically designed to meet your pole line hardware requirements.



TRANSFORMER CLUSTER MOUNTING BRACKETS



Only Chance offers this double-t
can be mounted at divergent ang
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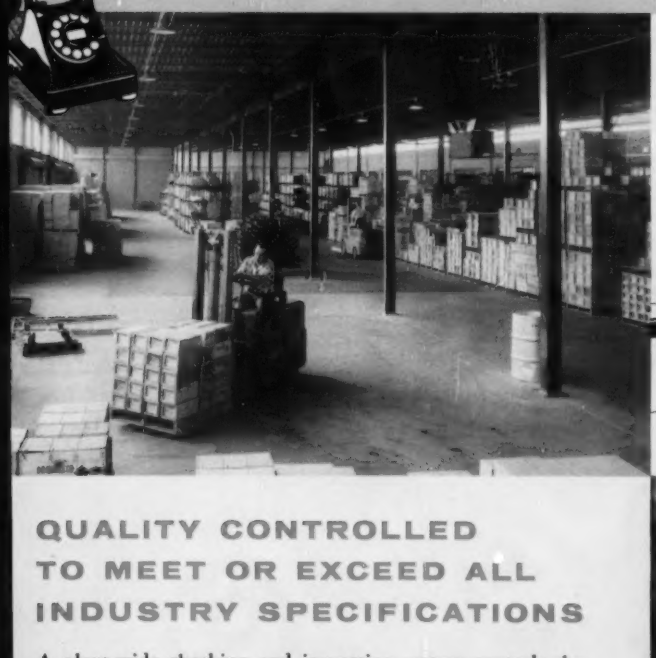
opposite sides of the pole with



GET FAST
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SUPPORT YOUR

For prompt
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QUALITY CONTROLLED TO MEET OR EXCEED ALL INDUSTRY SPECIFICATIONS

A plant-wide checking and inspection system controls the quality of all Chance Pole Line Hardware. Products are subjected to much more severe conditions in laboratory tests than would be encountered in the field, so that adequate safety factors can be built into Chance designs. Field tests of products in actual use prove their dependable performance. Production-run tests and continuous close inspection guarantee uniform quality.

QUALITY CONTROL IN AC
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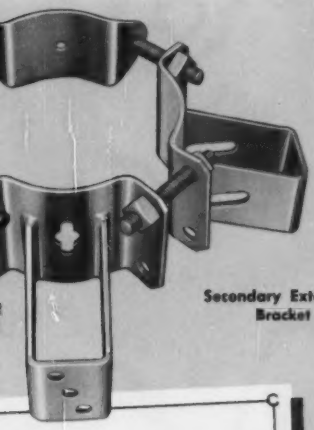
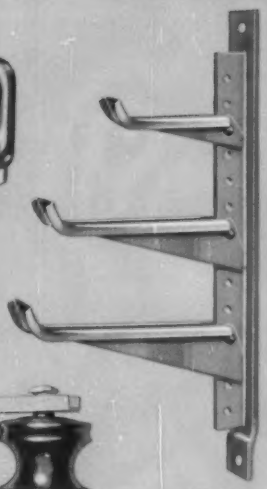


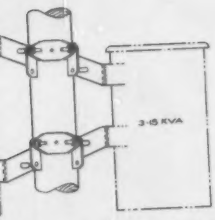
Secondary Extension Bracket

Wireholder

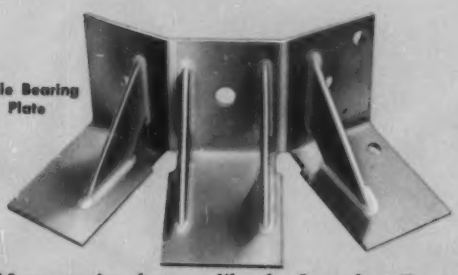


Underground Cable Racks and Hooks

Insulated Clevis



double-purpose feature: angled brackets
gent angles to support large transformers
to accommodate smaller transformers on
le with base spacing the same.



Pole Bearing Plate

Money saving features like the Secondary Extension Bracket that eliminates separate extensions ... stronger, easier-to-use designs like the Chance Insulated Clevis, Wireholder, and Underground Cable Racks and Hooks ... and brand new items like the Pole Bearing Plate (used in pairs) that prevents poles from "working up" out of the ground, are only a few of the many reasons it's to your advantage to specify CHANCE for Pole Line Hardware!

ST DELIVERY
NVENTORY
UR LOCAL SUPPLIER

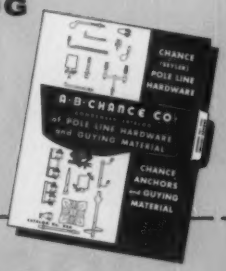
rompt delivery—for better service—just pick up
hone and order Chance Pole Line Hardware
your local supplier. Keep him informed of
your requirements so he can carry the
necessary stock, and you can order in
quantities most economical for your oper-
ations. BE SURE TO SPECIFY CHANCE.

N ACTION: Chance Pole Line Hard-
ed for pre-fit by these automatic
t detect and reject misfits—an ex-
control to eliminate field difficul-

FIND IT QUICKLY

IN THIS CONDENSED CHANCE CATALOG

Get this ready reference for everything you need in pole line hardware. A combination catalog and file folder — arranged to help you find what you want quickly and easily.



A. B. CHANCE CO.
Centralia, Missouri

Please send me the Chance condensed POLE LINE HARDWARE and GUYING MATERIAL CATALOG ... also special information on these NEW items:

- ☐ TRANSFORMER MOUNTING BRACKETS
- ☐ SECONDARY EXTENSION BRACKETS
- ☐ POLE BEARING PLATES

Name _____

Company _____

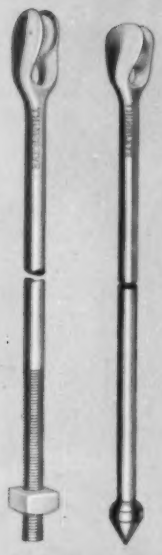
Address _____

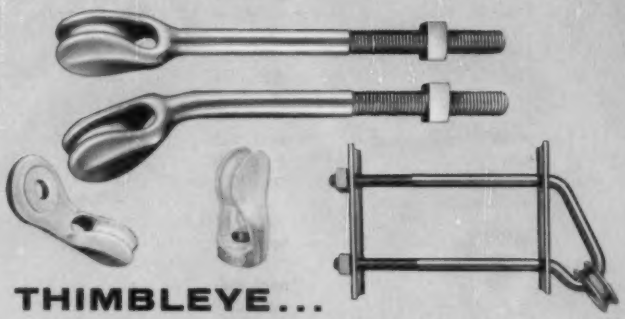
City & State _____

Name of Preferred Supplier _____

for a real good GUY *...always use*

CHANCE GUYING EQUIPMENT

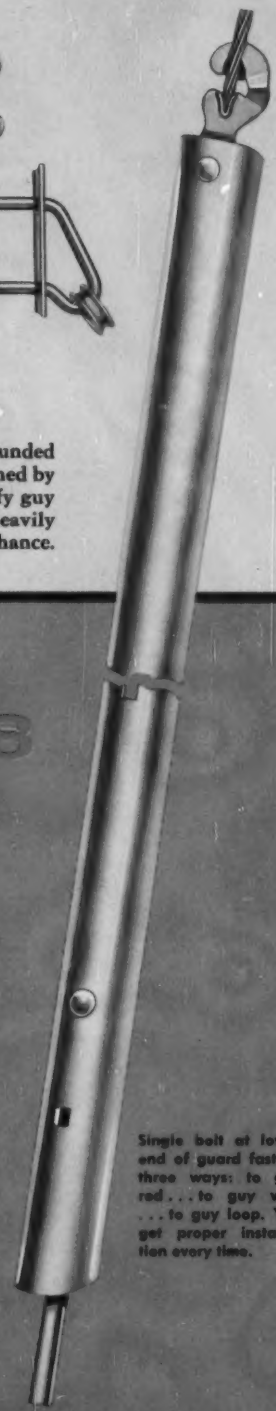




THIMBLEYE... a Chance contribution to BETTER GUYING

Chance Guy Fixtures and Anchor Rods with full-rounded Thimbleyes, Twineyes or Tripleyes (originally designed by Chance) give complete strand protection and simplify guy attachments. Drop forged from high grade steel—heavily galvanized. Always top quality when you specify Chance.

Flanged hook slips over the guy wire. No stretching for high bolts. Hook holds guard away from strand to eliminate noisy vibration.



and finish the job with the New CHANCE 808 GUY GUARD

ECONOMICAL IN COST

The new Chance 808 Guy Guard is a general-purpose, inexpensive guard designed for economy in first costs—in labor costs—in long life.

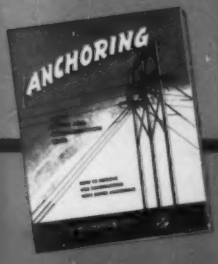
EASY TO INSTALL

The 808 hooks easily over the guy strand—fastens with a single nut. Only one wrench is needed.

GIVES LASTING PROTECTION

The 808 has no sharp edges to endanger the public. Edges are turned in for rigidity and safety. Heavy gauge steel guard is hot galvanized for long life and high visibility.

Single bolt at lower end of guard fastens three ways: to guy rod . . . to guy wire . . . to guy loop. You get proper installation every time.



GET THIS BOOKLET. It's the most complete guide to anchoring ever developed . . . full of how-to-do-it material to help you select the right anchor for every job—and install it properly. It's FREE!

CP57-5

A·B·CHANCE CO·

GENERAL OFFICES: CENTRALIA, MISSOURI

ABC INDUSTRIES

MEETINGS CALENDAR

SEPTEMBER

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Electric Companies Public Information Program—Steering Committee, Biltmore Hotel, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Michigan, September.

• **Edison Electric Institute**—Street Lighting Committee, Atlanta, Ga., Sept. 11; Farm Development & Promotion Committees, New York City, Sept. 11-12; Industrial Power & Heating Group, Van Curler Hotel, Schenectady, N. Y., Sept. 11-13; General Power & Heating, Competitive Service and Industrial Sales Methods & Development Committees, Schenectady, N. Y., Sept. 11-13; Market Research Committee, New York City, Sept. 12-13; Residential Lighting Policy Committee, New York City, Sept. 13; Housepower—NAWB Press Conference, New York City, Sept. 19; Accounting Division Organization Meeting, sponsored jointly by AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Minn., Sept. 23-25; Commercial Cooking, Lighting & Electric Space Heating Committees, New York City, Sept. 26-27; New England Dealer Workshop, Wianno, Mass., Sept. 26-27; Electrical Systems & Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Electric Companies Advertising Program—Management Group Meeting, Hotel Pierre, New York City, Sept. 13; Copy Group Meeting, Detroit, Mich., Sept. 25.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Southeastern Electric Exchange—Engineering & Operation Section, Biltmore Hotel, Atlanta, Ga., September 19-20.

Pennsylvania Electric Association—Structures and Hydraulics Committee, Highland Hotel, Massena, New York, Sept. 19-21.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 23-24.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

American Institute of Electrical Engineers—Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Illinois, September 24-25.

Inter-Industry Farm Electric Utilization Council—National Power Workshop, Fourth Annual Meeting, Shirley-Savoy Hotel, Denver, Colo., Sept. 29-Oct. 1.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3; Communications Committees, Abraham Lincoln Hotel, Reading, Pa., Oct. 7-8; Meter Committee, Shenango Inn, Sharon, Pa., Oct. 10-11; Relay Committee, Abraham Lincoln Hotel, Reading, Pa., Oct. 17-18; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pa., Oct. 24-25; Transmission & Distribution Committees, Lord Baltimore Hotel, Baltimore, Md., Oct. 31-Nov. 1.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

Missouri Valley Electric Association—Sales & Rural Conference, (and Home Service Workshop), Lassen Hotel, Wichita, Kansas, Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

Iowa Utilities Association—Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

Edison Electric Institute—Prime Movers Committee, Hotel New Yorker, New York City, Oct. 7-9; Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Virginia, October 23-25.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, American Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—13th Annual Meeting, Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Ill., Oct. 7-11; Computers in Control Symposium, Hotel Claridge, Atlantic City, N. J., Oct. 16-18.

Electrical Association of Philadelphia—15th Electrical Progress Show, Convention Hall, Philadelphia, Pa., Oct. 8-10.

Southeastern Electric Exchange—Accounting Section, Fort Sumter Hotel, Charleston, S. C., Oct. 10-11; Sales Section, Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., Oct. 14.

National Safety Congress—Conrad Hilton Hotel, Chicago, Ill., Oct. 21-25.

• **Engineers Joint Council**—25th Annual Meeting & 4th Annual General Assembly, Statler Hotel, New York City, Oct. 24-25.

Oklahoma Utilities Association—Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla., Oct. 25.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

• Additions this week.

Shipments and Orders for Electrical Equipment, 1956-1960

Total Capacity Shipped and on Order and Scheduled for Shipment	Shipped 1956	Shipped First 6 Months of 1957	Scheduled as of July 1, 1957: Last 6 Months of 1957	1957	1958	1959	1960 And Later	Total Scheduled for Shipment as of 7-1-57	New Capacity Scheduled 1-1-57 to 7-1-57
LARGE STEAM TURBINE-GENERATORS[2] (10,000 Kw and Larger)[3]									
U. S. El Pwr Sys.	6,610,400	3,989,100	6,913,400	10,902,500	14,109,300	10,385,200	2,972,300	34,380,200	4,677,900
U. S. Industrials	391,800	490,400	811,600	1,302,000	130,000	600,000	.....	1,541,600	570,000
Outside U. S.	652,600	278,500	240,800	519,300	1,142,900	1,726,800	.....	3,110,500	1,190,000
TOTAL	**7,654,800**	**4,758,000**	**7,965,800**	**12,723,800**	**15,382,200**	**12,712,000**	**2,972,300**	**39,032,300**	**6,437,900**
SMALL STEAM TURBINE-GENERATORS[2] (4,000 to 9,999 Kw)[3]									
U. S. El Pwr Sys.	130,400	31,900	13,700	45,600	31,300	.....	.....	45,000	9,400
U. S. Industrials	80,000	91,900	50,600	142,500	42,500	.....	.....	93,100	20,600
Outside U. S.	91,200	47,500	41,300	88,800	28,100	.....	.....	69,400	14,400
TOTAL	**301,600**	**171,300**	**105,600**	**276,900**	**101,900**	.....	.....	**207,500**	**44,400**
STEAM GENERATORS (450-Psi Pressure and Higher)[4]									
U. S. El Pwr Sys.	54,514	43,978	59,231	103,209	96,057	25,405	575	181,268	29,425
U. S. Industrials	15,175	17,116	10,720	27,836	9,716	4,825	.....	25,261	11,608
Outside U. S.	13,518	3,686	10,697	14,383	12,284	2,896	485	26,362	8,221
TOTAL	**83,207**	**64,780**	**80,648**	**145,428**	**118,057**	**33,126**	**1,060**	**232,891**	**49,254**
WATERWHEEL GENERATORS[5] (4,000 Kw and Larger)[3]									
U. S. El Pwr Sys.	1,085,300	831,700	970,300	1,802,000	2,195,800	610,900	158,000	3,935,000	934,600
U. S. Industrials	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	86,500	12,000	35,900	47,900	153,500	.....	.....	189,400	50,500
TOTAL	**1,171,800**	**843,700**	**1,006,200**	**1,849,900**	**2,349,300**	**610,900**	**158,000**	**4,124,400**	**985,100**
HYDRAULIC TURBINES (5,000 Hp and Larger)[6]									
U. S. El Pwr Sys.	1,223,700	1,056,400	1,545,200	2,601,600	2,379,500	2,465,000	2,302,700	8,692,400	2,021,700
U. S. Industrials	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outside U. S.	11,400	.....	107,300	107,300	122,300	.....	.....	229,600	5,000
TOTAL	**1,235,100**	**1,056,400**	**1,652,500**	**2,708,900**	**2,501,800**	**2,465,000**	**2,302,700**	**8,922,000**	**2,026,700**
POWER TRANSFORMERS (501 Kva and Larger)[7]									
U. S. El Pwr Sys.[1]	54,438,000	37,075,000	31,605,000	68,680,000	17,908,000	5,471,000	400,000	55,384,000	30,481,000
Outside U. S.	744,000	656,000	1,135,000	1,791,000	105,000	.....	.....	1,240,000	1,572,000
TOTAL	**55,182,000**	**37,731,000**	**32,740,000**	**70,471,000**	**18,013,000**	**5,471,000**	**400,000**	**56,624,000**	**32,053,000**

[1] U. S. Electric Power Systems and U. S. Industrials. [2] Manufacturers' maximum rated capability [3] Figures in Kilowatts. [4] Figures in 1,000 lb steam per hr. [5] Manufacturers' rating of generators. [6] Figures in horsepower. [7] Figures in kilovolt-amperes.

43,364 Mw on Order, EEI Reports

While slightly under April record capacity of 44,449 Mw, this is over 2,000 Mw greater than last year. Orders for large units placed now will not be shipped any earlier than 1960

Total generating capacity of 43,364 Mw was on order and scheduled for shipment on July 1. This is slightly under the record high of 44,449 Mw on April 1 (EW, June 24, 1957, p 191), but slightly over two million kilowatts greater than at July 1, 1956. These figures were reported in the interim electric power survey of Edison Electric Institute just released.

The data shown includes the total of U. S. electric power systems, U. S. industrials, and outside the U. S., unless otherwise noted.

Here are some highlights of the interim survey:

Any orders that might be placed now for the larger units are for 1960 shipment or later. As the scheduled rate of shipment is increasing, shipments are being made close to schedule. For instance, shipments of large steam turbine-generators (10,000 kw and larger) amounted to 37% of 1957's goal; generators for hydraulic turbines (4,000 kw and larger) 46%; and power transformers (501 kva and over) 53%.

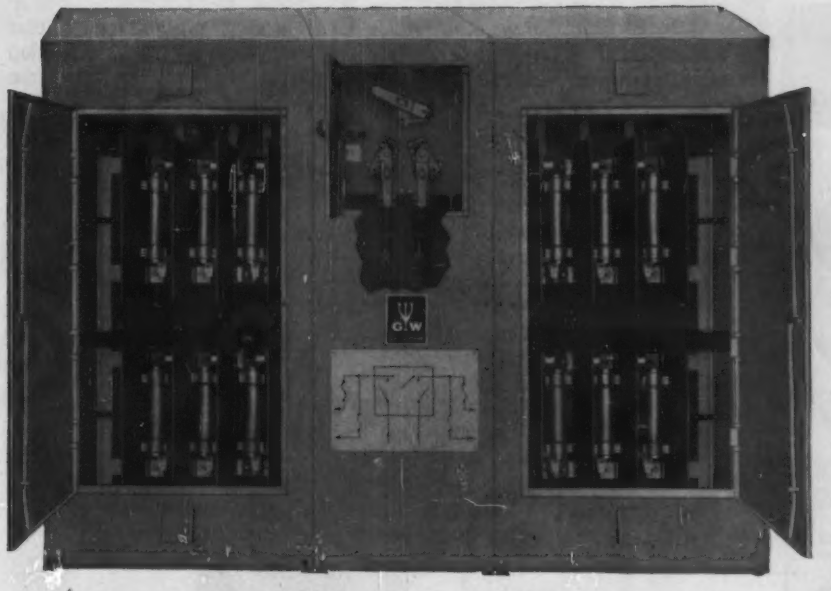
New orders for thermal and hydro generating capacity exceeded shipments for the first half of 1957 for the three types of purchasers.

There were no exceptionally large turbine-generator units ordered or shipped in the second quarter. However, the 275-Mw Will County No. 3 unit of Commonwealth Edison Co went into operation in June, 1957.

Now scheduled to go into commercial operation in November is the 100-Mw nuclear plant of Duquesne Light Co at Shippingport, Pa. The 125-Mw super-critical unit at Philo station of the Ohio Power Co went on the lines in August.

Shipments of small steam turbine-generators totaled 171,300 kw in the first half of 1957 with 105,600 kw to be shipped in the second half. The only orders for this type of equipment placed during the second quarter of 1957 are for units to be shipped outside of

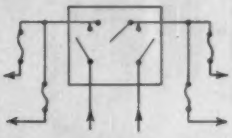
(*More M&M on page* 116)



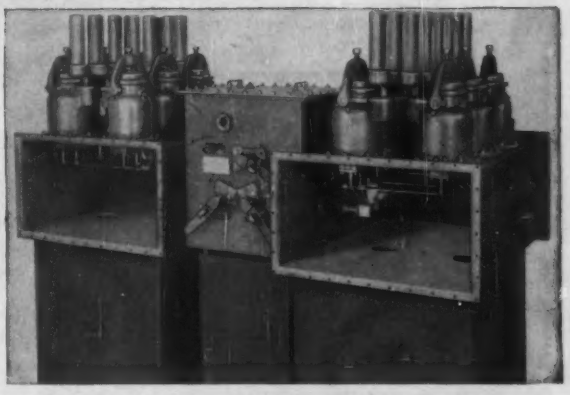
Type "SCRA" unit, 3 pole, 5000 volts, 400 ampere, 4-way oil switch with 4 sets of high interrupting capacity power fuses. Similar units are available in 15 Kv. and higher voltage ratings.

FLEXIBILITY for 2 Feeds & 4 Loads

— safely and economically provided by G & W load break oil switches combined with power fuses or with oil fuse cutouts.



The schematic diagram above applies to either combination unit illustrated. The Type "RA" load break oil switch has three sets of manually operated links. Normally, the upper set of links are open and two loads are supplied from each feeder separately. By opening either set of lower links and closing the upper links, all four loads can be supplied by either feeder.



Type "FCRA" unit, 3 pole, 5000 volts, 400 ampere, 4-way oil switch with 4 sets of "FC42" oil fuse cutouts, 5000 volts, 200 amperes, gang operated.

Get in touch with us or our nearest representative for information on combination Fuse-Switch units for your high voltage distribution centers.

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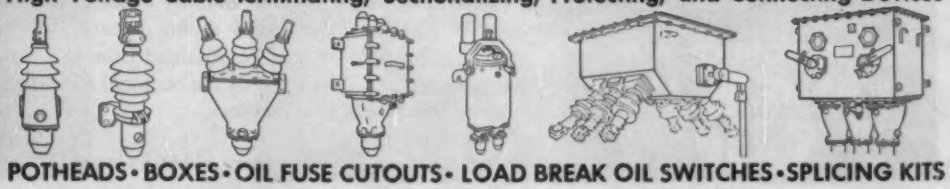

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*Versatility

*Is the middle name of the Neale Model "K" pull type spinner . . .

- Spins new and existing cable
- Has instant adjustment from minimum to maximum cable sizes
- Spins one or two spirals
- Lashes one, two or three cables at one time
- Uses all sizes and types spinning wire
- Weighs only 36 pounds

THE MODEL "K" IS TRULY A VERSATILE CABLE SPINNING MACHINE

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the U. S. In 1958 there is scheduled a total of 101,900 kw while in 1959 and later nothing is scheduled. Orders for this type of equipment are usually placed about a year ahead of delivery date.

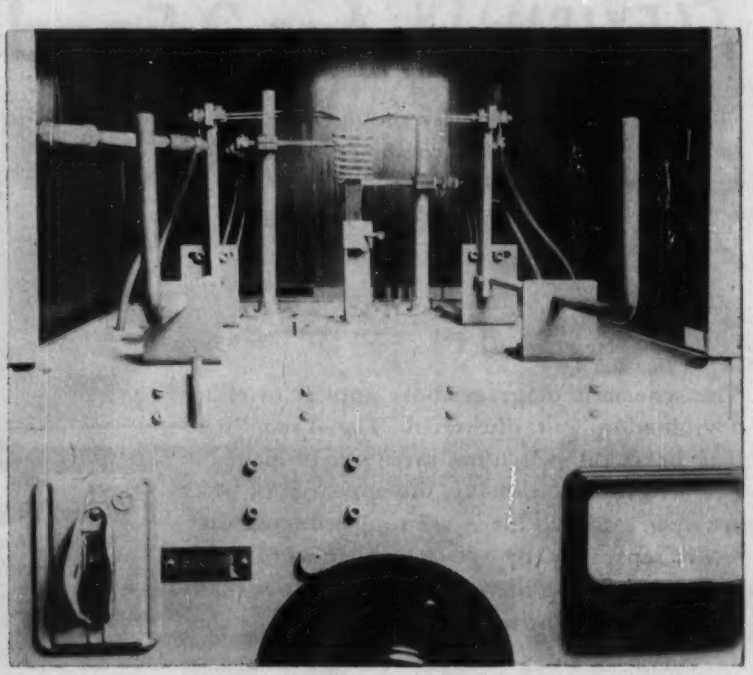
Steam generator capacity (450-psi pressure and higher) scheduled for shipment in 1957 may hit 145,-428,000 lbs of steam per hour, surpassing the previous record of 119,-472,000 lbs in 1952.

Scheduled 1957 production of power transformers has increased by 7% since the report of last April reaching more than 70-million kva. This is 18% higher than the record production in 1954 which totaled over 59-million kva.

The EEI said, in releasing the interim report, that "it has the same coverage as that of the regular semi-annual report." It is intended to show the general situation at the mid-point of 1957.

Starts Maintenance Tour

A field service vehicle and trailer is now employed by Allis-Chalmers service staffs in preventive maintenance of regulators. In planned tours of installations, representatives check feeder voltage regulators and teach maintenance procedures to their users. Trailer-truck units are equipped with component parts, tools, test equipment, and oil handling machinery.



Test Laminates for Fire Hazard Use

Flame-retardent laminates suited for use in high-voltage electrical switchgear and other electrical equipment are shown above undergoing flammability tests in the Continental Diamond Fibre Corp plant at Bridgeport, Pa.

Determination of the flammability index of the laminates, which can be used in equipment subjected to fire hazards resulting from arc-over or dielectric breakdown, can be obtained from the unit. The test equipment has been recently developed by the National Electrical Manufacturer's Association Switchgear Committee.

(*More M&M on page* 118)

How to improve heat-rate of Station "A"?

ASSUMING LOADS AND PEAKS are increasing or that the boiler will soon be derated . . .

An improvement of 5 to 6% in the over-all heat rate might very easily be accomplished by combining a Westinghouse gas turbine-generator with an existing steam turbine-generator, using the gas turbine exhaust for:

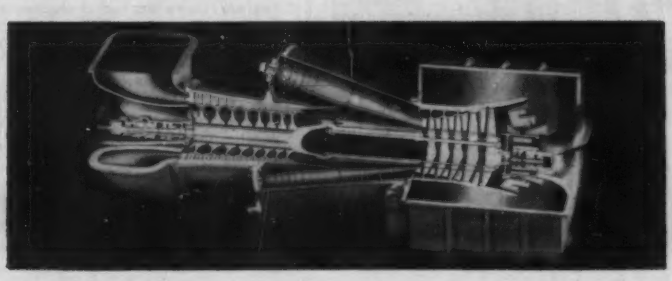
heating feedwater . . . to take the extraction drain off the steam turbine, increasing its capacity without adding to the boiler load.

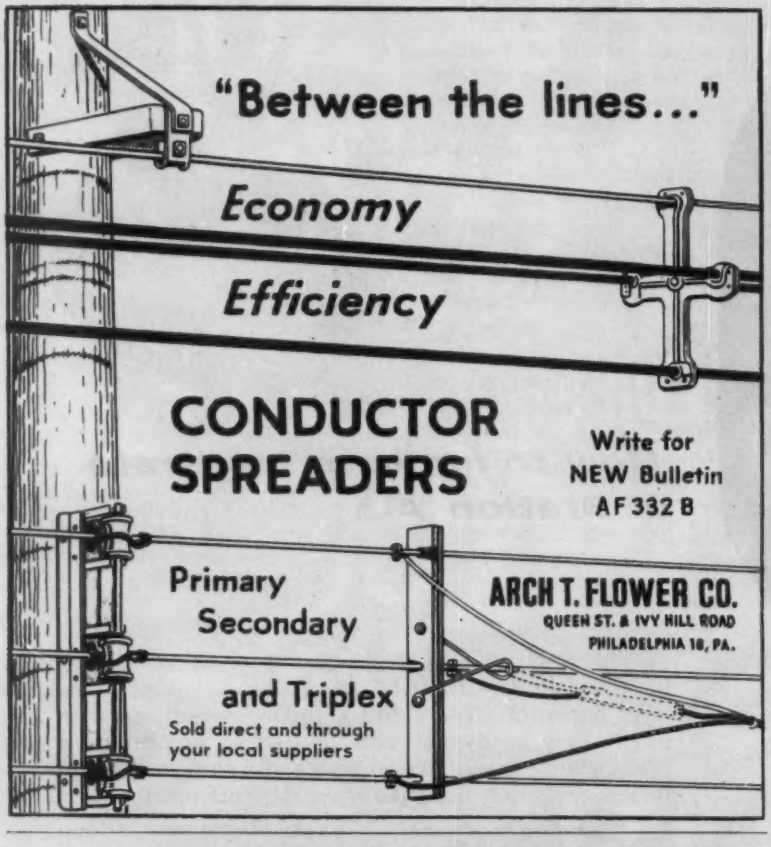
combustion air . . . the gas turbine exhaust can be used as highly preheated combustion air to promote the efficiency of a steam boiler.

generating steam . . . the turbine exhaust can be used in a recovery boiler to generate steam for a low-pressure turbine.

Challenge us to show you how a modern gas turbine might be the economical solution to the demand for greater generating capacity or increased operating efficiency. Contact your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50596

YOU CAN BE SURE...IF IT'S Westinghouse





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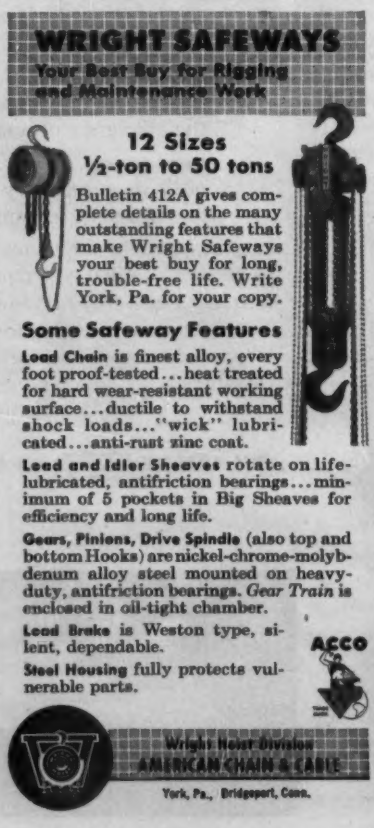
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Load Chain is finest alloy, every foot proof-tested ... heat treated for hard wear-resistant working surface ... ductile to withstand shock loads ... "wick" lubricated ... anti-rust zinc coat.
Load and Idler Sheaves rotate on life-lubricated, antifriction bearings ... minimum of 5 pockets in Big Sheaves for efficiency and long life.
Gears, Pinions, Drive Spindle (also top and bottom Hooks) are nickel-chrome-molybdenum alloy steel mounted on heavy-duty, antifriction bearings. Gear Train is enclosed in oil-tight chamber.
Load Brake is Weston type, silent, dependable.
Steel Housing fully protects vulnerable parts.
ACCO
Wright Hoist Division
AMERICAN CHAIN & CABLE
York, Pa., Bridgeport, Conn.

Ohio Brass Co Assures Capacitor Electrical Tests

Assured final electrical tests for all capacitors is the main feature of the conveyorized system at the Ohio Brass Co, Mansfield, Ohio, plant.

Varex capacitors, after being metallized with zinc spray, move on the conveyor system to the test area. This eliminates the chance of a capacitor not being tested as it has to pass through the test area before being painted or packaged.

Upon arrival in the test area, the capacitors are moved through a series of test positions by a gear motor which automatically stops at each one. While traveling around the three-quarter circular test path, the capacitors undergo the following checks: terminal-to-terminal overvoltage test, discharge rate of discharge resistors, terminal to case overvoltage test, and readings of capacitance and dielectric losses at rated frequency and voltage.

U. S. Copper Production

Primary production of copper in the United States decreased 9,677 tons from June's total to 86,216 tons for July, according to a report of Copper Institute, N. Y. A drop to 127,434 tons for refined production was given for the month of July as compared to June's 134,270 tons. Also on the decline were deliveries to fabricators which totaled 84,702 for July. This was about 17,000 less than in June. Still increasing were refined stocks which went up 25,966 tons from 165,549 tons to 191,515 tons for July.

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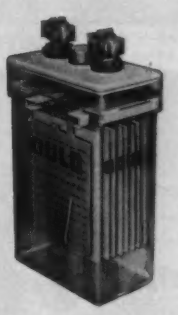
It isn't just by accident that your Gould Batteries give you extra long service, extra waves of power. That extra life is carefully built into each battery right at the factory. Precise manufacturing techniques have been developed by Gould which assure accurate duplication of construction in cell after cell . . . couple this with Gould's policy of providing regular routine inspection of installations by Gould field engineers and you can see why you get more waves of carefree power with every Gould Battery you buy. Gould-National Batteries, Inc., Trenton 7, N. J.



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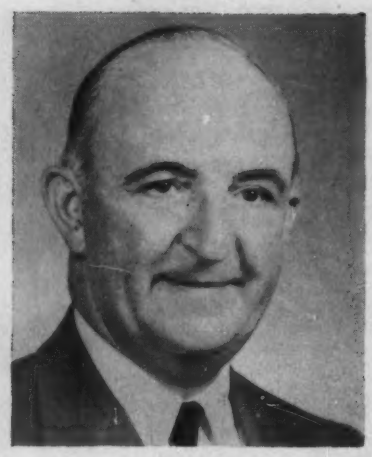

Ohio Edison Ups Brunenmeister

Ohio Edison Co has announced the recent election of Otto Brunenmeister, Jr, as a vice president of the company. The post of comptroller, left vacant by his promotion, has been assumed by E. A. Ladd.

The new vice president has served as comptroller of the utility for the past 21 years. In addition, he has been a member of the board of directors since 1938.

Ladd comes to his new position after having served as general auditor of the company since 1950. He has been affiliated with Ohio Edison and predecessors since 1922.

OTTO BRUNENMEISTER

W. B. MORTON

M. D. ENGLE

C. A. CARPENTER

S. C. TOWNSEND

Eight PP&L Officials Named to New Posts

F. C. MUELLER

M. S. LAWRENCE

In a series of executive promotions, Pennsylvania Power & Light Co has named F. C. Mueller vice president of its new Central Division and transferred M. S. Lawrence to the Susquehanna Division to temporarily assist Division Vice Pres E. E. Mensch, who retires shortly.

Members of the engineering and construction department with new titles include Walter B. Morton, who becomes chief electrical engineer; M. D. Engle, chief mechanical engineer; C. A. Carpenter, chief system planning engineer; S. C. Townsend, manager-atomic engineering; W. H. Stang, manager-engineering services; and B. C. Seitzinger, construction manager.

Mueller, former Schuykill Division vice president, will now head the division recently formed through the consolidation of the Luzerne and Schuykill components. A 33-year PP&L veteran, he has also been district and division manager.

Lawrence is former Luzerne Division vice president. During his 29 years at PP&L, he has been division manager and secretary.

W. H. STANG

B. C. SEITZINGER

1. MID-SPAN TAPS help bring down the over-all cost of distribution with Rome's Triplex SD and secondary cable. You can tap between poles from either side, using conventional hardware plus a spreader block. Simple; fast; saves service wire. You save on pole cost, too—*as much as one-third*. With Rome's Triplex secondary you can span 300 feet from pole to pole. Use fewer poles; save time setting them; eliminate crossarms.

2. SAVE ON HARDWARE. Here's a comparison between the hardware needed to install one open-wire service drop (right)—using one pole—and Rome's aluminum Triplex equivalent (left) using a mid-span tap.

3. CUT MAN-HOURS on installation jobs. Triplex goes up much faster than open-wire service, because it requires less handling, less time installing hardware. It's easier to handle, too—aluminum cable assembly weighs less than conventional copper service wires.

If you take advantage of these important savings . . .

"Expensive" Triplex cables can cost less

Triplex sometimes *does* cost more than its open-wire equivalent.

But its on-line cost can be lower—*if you take advantage of the installation economies* that Triplex alone makes possible.

Fewer poles . . . less hardware . . . faster installation—these are the savings you make with Triplex. They can more than offset any extra cable cost.

In addition, there are many locations where you can improve service and reduce maintenance with Rome's aluminum Triplex. Wooded areas, for example—where Triplex *stays up* despite falling tree branches that might knock out open-wire secondaries. Residential streets, too—where good public relations indicates need for a neat, uncluttered installation.

Fits your modernization pattern

Introduced 10 years ago, Rome's Triplex SD Cable won almost immediate acceptance. As a next step in modernization, many utilities are now using lightweight aluminum Triplex for overhead secondaries as well. If you haven't yet adopted this practice, we invite you to look into the operating advantages—as well as the economies—that this Rome "package" concept offers you.

Specify Rome's aluminum Triplex for your next job. For more information, contact your nearest Rome Cable representative—or write to Department 368 and ask for descriptive Bulletin RCP-361. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

O'Sullivan and Roy Elevated by Quebec Hydro

The Quebec-Hydro Electric Commission has named Louis O'Sullivan as commissioner and Leo Roy as general manager.

O'Sullivan, former assistant general manager, succeeds John McCammon, who has retired. During his 34 years with Hydro-Quebec and predecessors, O'Sullivan has gained experience in both system operation and administration as field, designing, transmission, and rights-of-way engineer, and as general executive assistant of the utility.

Roy has been chief engineer of auxiliary services since 1952. During his 25-year utility career he has also been engineer-electricity and gas sales, and superintendent of power transmission-distribution section.

LEO ROY LOUIS O'SULLIVAN

PERSONAL BRIEFS

Ohio Power Co's **Walter R. Ankrom** has been appointed director of industrial sales of American Gas & Electric Service Corp. He assumes the post left vacant by the promotion of **Paul W. Emler** to assistant vice president—commercial.

Merle G. Kaetzel is new assistant to the president of Potomac Edison Co.

At Kansas Power & Light Co, **Otis Jeannin** has been elevated to Great Bend Division manager and **Leslie Olm** to local manager at Lyons.

Richard E. Ballard has been designated assistant commercial sales manager of Connecticut Light & Power Co. He continues as street lighting engineer for the utility.

Recently promoted at Ohio Edison Co were **William S. Tayman,** to company safety coordinator; and **Paul M. Gentzel,** to superintendent of electric transmission and distribution, Manfield Division. He replaces **R. D. Iden,** retired.

The Charleston district of Appalachian Electric Power Co has named **Ronald H. Hively** as its new commercial manager . . . **Tom Albright** recently became director of safety and training at Carolina Power & Light Co.

F. Warren Cooper has retired as vice president and comptroller of Public Service Electric & Gas Co.

Owen W. Hurd, manager of Benton County PUD at Kennewick, Wash., was recently named managing director of the Washington Public Power System. WPPS was formed earlier this year by 17 PUD's to develop electric power generating and transmission facilities.

Pennsylvania Power & Light Co appointed **Bartow Van Ness, Jr,** as assistant chief electrical engineer and **E. P. Welch** as assistant manager of engineering services.

William Parkerson has joined American & Foreign Power Co, Inc, as assistant manager of the rate department . . . Ebasco International Corp has elected **Jose Gomez** as assistant comptroller. He continues as treasurer and accounting consultant for Cuba.

Walter G. McKie, Rochester Gas & Electric Corp's general sales manager, has been elected to the executive committee of the commercial section of Edison Electric Institute. He is also new chairman of the executive committee of the Better Light Better Sight Bureau.

Westinghouse Electric Corp has made these appointments: **David C. Fulton,** to manager, heat transfer apparatus department, Steam Division; **Glenn Bates,** Pacific Coast switchgear supervisor; **William B. Cott,** assistant to the vice president, Air Conditioning Division; **Paul J. Bridwell,** manager of industrial products advertising; **J. A. Cunningham,** manager of utility products advertising; and **Robert T. Scott,** manager of community relations for the company.

Malcolm T. Means is new manager-finance for General Electric Co's advertising and sales promotion department.

John E. Barkle has joined the power division of Bechtel Corp as assistant chief electrical engineer. A Westinghouse Electric Corp employee from 1939 to 1956, he most recently has been in private business in Eureka, Calif.

Newly elected vice president of sales for Olin Aluminum is **Sam Gurley, Jr,** who most recently served as vice president-sales of H. K. Porter Co, Inc.

Minneapolis-Honeywell Regulator Co has named **George W. Hoffmeister** as general superintendent of its new plant at Fall River, Mass.

OBITUARY

Isaac Harter, 77, consultant and former vice president of Babcock & Wilcox Co, died recently of a heart ailment.

Ansel A. Packard, 63, assistant to the president of Connecticut Power Co since early this year, died recently at his Portland, Conn., home.

Rome's lightweight Triplex goes up much faster than open-wire service drops

Reduce your service-drop installation time—even by a few minutes—and you save money. Now it's possible to speed up practically every job.

High dollar savings. Rome's aluminum Triplex can be installed much faster than open-wire service drops. Multiply the time it saves by the high cost of keeping your crew on the job, and you'll see how great the savings are in manpower costs alone.

Why such savings are possible. The lightweight construction of Rome's aluminum Triplex is behind these important savings. This single-cable assembly weighs less than conventional copper three-wire service drops, so it's easier to handle and quicker to install.

Rome's aluminum Triplex offers simplicity in construction. A self-supporting cable, it consists of specially insulated power conductors spiralled around a "straight-away" neutral conductor. Less handling is required to pull it off the truck, string it, and connect it than conventional three-wire service drops.

You can purchase this economical service drop cable in handy 500-foot cartons, paper-wrapped coils, or on non-returnable reels.

Specify Rome's aluminum Triplex for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 366-B and ask for Bulletin RCP-361. Rome Cable Corporation, Rome, N. Y.

Plus these benefits!

Costs Less. Initial cost is lower than conventional copper Type SD service drop cable.

Lasts Longer. Maintenance and service interruptions are few compared to open-wire installations. It offers maximum resistance to storms, wind and ice loading.

Fewer Poles Required. Fewer poles are required and longer spans are possible with mid-span taps on secondary Triplex.

Less Hardware Needed. Service tap connections at the pole require less hardware than a conventional three-wire tap.

ROME CABLE

CORPORATION

Control LTC's to Operate in Parallel (*Continued from page 66*)

average position; transformers lower in voltage than the average move toward the average position. This operation is the same as that of transformers brought together by reversed-reactance control.

Current Divided Equally

The division of load-current line-drop compensation, used in the current-balance method, is shown in Fig. 4. Secondaries of the parallel equalizing transformers (CB) are in series, causing equal currents to flow in each of three lines to the line-drop compensator. In effect, this circuit vectorially adds the total line current of all LTC transformers operating in parallel and divides it equally among all transformers in parallel.

Line-drop compensators of all transformers are connected for the same reactance and resistance. When one transformer is taken out of service, these connections are not disturbed; current continues to circulate to the compensator of the idle LTC transformer. When the LTC transformer is removed, resistance and reactance of each line-drop compensator must be reset.

So that equipment of different manufacturers can be paralleled readily, the circuit in Fig 5 has been adopted as the standard current-balance control method. This scheme incorporates the partial circuits in Figs 3 and 4.

In the electrical interlock step-by-step method of controlling LTC transformers, tap-changing mechanisms of each LTC transformer are kept within one step of each other by relays operating in the motor circuit. Probably the least complicated, this is yet the most reliable electrical interlocking method. In Fig 6, the mechanism of each LTC transformer has a switch (MSE) which is closed on even-number positions; another switch (MSO) is closed on odd-number positions. Relay (A) with normally open and closed contacts also is used. One voltage control relay controls both LTC transformers.

When both transformers are on the same position, relay (A) is energized. Should the voltage control relay call for a raise in voltage through closing of contact VR, only one LTC transformer makes a tap change. When this tap change is completed, relay (A) is de-energized, preventing the first transformer from making further "raise-voltage" tap changes and permitting only the second to raise.

Requires Extra Equipment

For more than one tap change, the sequence is repeated. Each time one transformer changes its tap position one step, circuit voltage is changed one-half step; it is possible for both transformers to come to rest one step apart. In this situation control relays are in such a position that the higher-step transformer can only lower and the lower-step unit can only raise. The step-by-step electrical interlock method requires special switches on the tap-changing mechanism and an auxiliary relay and interconnecting wires.

The electrical interlock lock-in-step method is used when parallel transformers must be held on exactly the same tap except while changing taps. A simplified diagram for this control scheme is Fig 7. When a tap change is required, motor circuits of all transformers are sealed-in until each makes a tap change. Following a tap change, the motor circuit for each transformer is open until all are on the same position.

Has Complicated Circuits

The lock-in-step method requires switches on the tap-changing mechanism of each LTC transformer, six auxiliaries and 15 interconnecting wires between LTC transformers in parallel. If more than two are paralleled, more relays are required and the circuit becomes more complex. Because such complicated circuits are not usually justified, this method should be used only where no other is applicable.

An earlier scheme of keeping tap changers on the same position involved mechanical connection of either the driving motors or the mechanism of the tap changers by shafting between transformers. This required alignment of the tap-changing mechanisms. It is seldom used today because it is more expensive than other methods.

READERS FORUM

Notes Conflict

The "Specification Data for Watthour Meters" appearing as an Engineering Reference Sheet in your July 29 issue provides considerable information which will be helpful to the metermen of the electric utility industry. However, the concluding sentence of the article is in conflict with developments in the electric meter industry that have occurred during the past year. You state, "If the extra expense of the high capacity meter is warranted . . ." indicating that the 200 ampere capacity meter (whether 50 or 30 ampere rated) is higher priced. Since September 1956 the price of 200 ampere and 100 ampere capacity meters have been the same.

The recent introduction of General Electric's type I-60 meter rated at 30 amperes with 200 ampere continuous service capability was the purpose of providing a meter with such outstanding performance characteristics and inherent low cost that metermen will not have to be concerned with costs or meter capability in selecting a single phase meter for 60, 100 or 200 amp services. It is quite practicable, therefore, to install a Class 200 ampere (50 or 30 amp rated) in a standard capacity meter socket. Selection of the socket is based on providing capacity adequate for the maximum load expected rather than upon the capacity of the meter used.

Floyd H. Busch, Manager
Meter Dept
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Somersworth, N. H.

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3—1000 KVA Penn 33000-2500/4330Y
3—1000 KVA Mol 13200-2400/4160Y
3— 667 KVA Mol 2400-480
3— 500 KVA W-H 33000-2400/4160Y
3— 500 KVA G-E 22000-2300/4000Y
3— 500 KVA G-E 2400/4160Y—240x480
3— 333 KVA Mol 2300—230x460
3— 333 KVA Penn 2400—240/480
3— 250 KVA W-H 22000-7200/12470Y
3— 200 KVA A-CH. 34450-2400/7200
6— 150 KVA W-H 2400-120/240
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Reliable rewind and repair service on all makes of transformers

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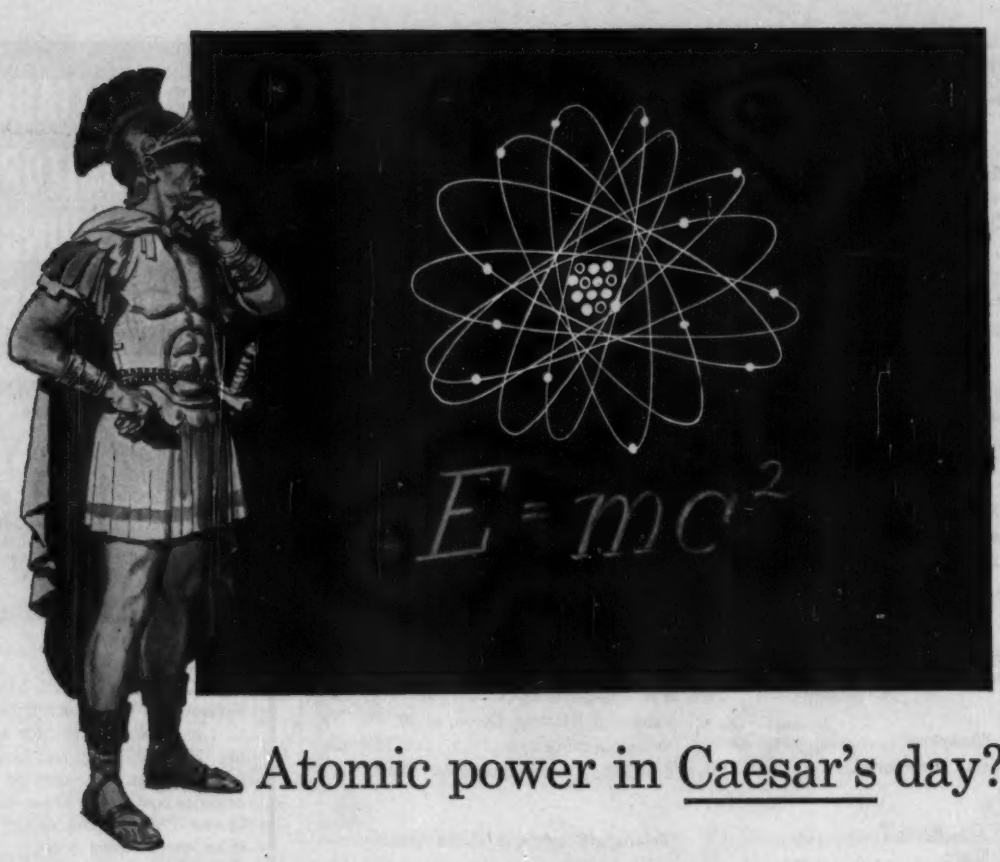

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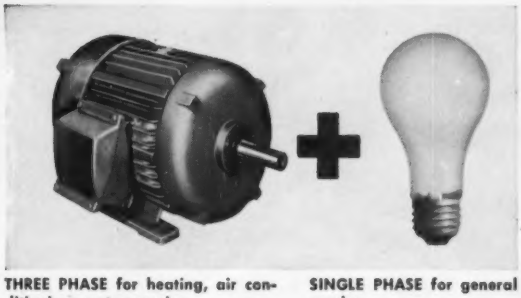

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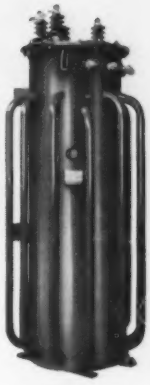

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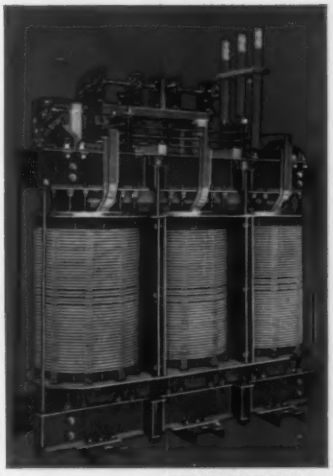

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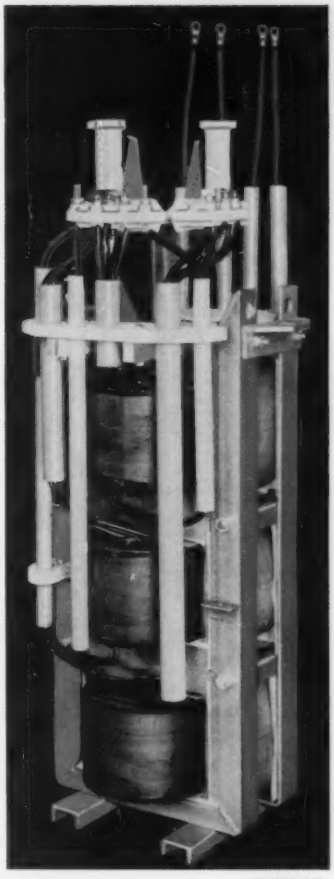

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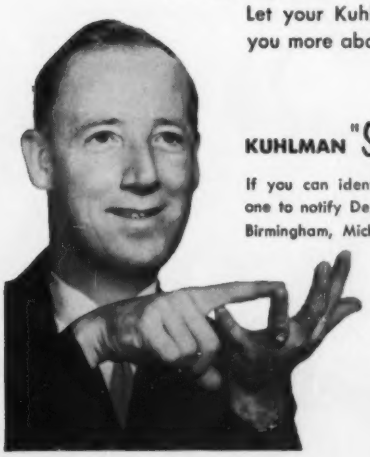

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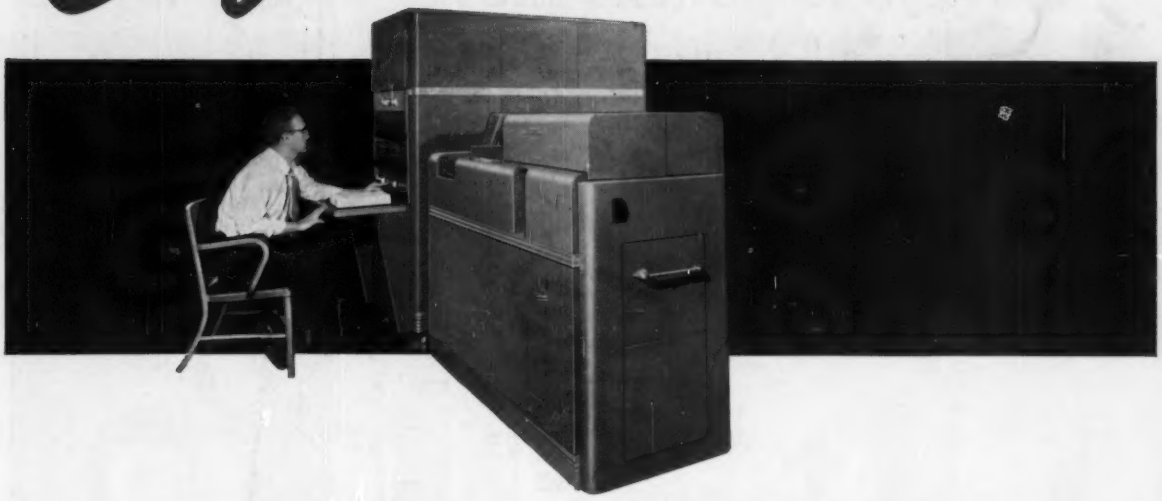
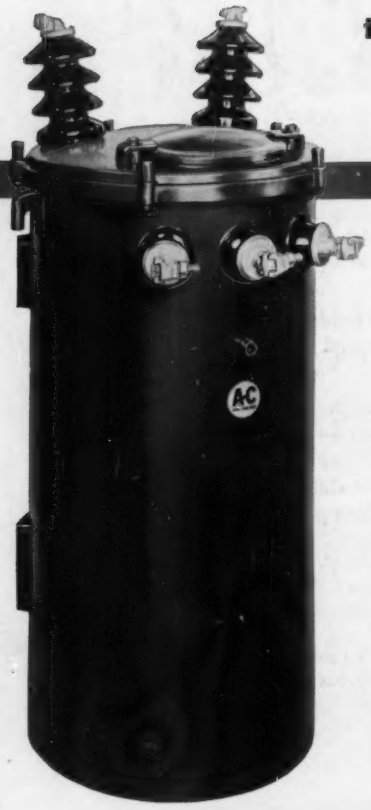


...gets an assist from the *Digital Computer*



In a continuing redesign program of distribution transformers, Allis-Chalmers engineers combine their skill with the electronic magic of a digital computer. Working with selected values for variables and with rejection criteria, the computer facilitates selecting the best possible transformer design.

Engineering Skill Vital

Obviously, the ingenuity of the engineer feeding data to the computer is all-important. The final choice of a design from the many acceptable ones produced by the machine is left to the experienced judgment of the engineer. The outstanding acceptance of the Allis-Chalmers redesign program speaks volumes for its engineering leadership.

Balanced Design Results

By combining engineering skill with the controlled data output of the computer, Allis-Chalmers has come up with a balanced design — a design in which each feature complements the others to provide unexcelled performance and long transformer life.

Get the complete computer story from your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

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